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Executive Summary

In 2002, the California Renewables Portfolio Standard (RPS) was established with the passage of Senate Bill 1078 (SB 1078, Sher, Chapter 516, Statutes of 2002). The RPS requires certain retail sellers of electricity to increase their sales of electricity from renewable energy by at least 1% per year achieving 20% by 2017 at the latest.

Senate Bill 1038 (SB 1038, Sher, Chapter 515, Statutes of 2002) requires the Energy Commission to develop a renewable resource assessment by December 1, 2003 and the California Public Utilities Commission (CPUC) to develop a renewable energy transmission plan by the same date. The purpose of this report is to facilitate the coordination of these tasks by providing a preliminary renewable resource assessment that can be used by the CPUC to develop their renewable transmission plan.

This study provides research results and analysis of several different aspects of renewable energy resource demand and supply, including:

- Estimation of retail sales of electricity
- Estimation of renewable energy capacity additions by retail sellers required to meet the Renewable Portfolio Standard (RPS)
- Assessment of data on existing and proposed renewable generation that may be available in the near-term
- Estimation of technical potential of renewable generation in California and the states of the Western Electricity Coordinating Council (WECC)
- Estimation of a plausible scenario for development of renewable resources to meet the RPS

Table 1 identifies the estimated cumulative additional procurement of renewable energy for retail sellers -- Investor Owned Utilities (IOUs) and Electric Service Providers/Community Choice Aggregators (ESP/CCAs) -- beyond the 2003 Interim Procurement, to achieve the RPS goals set out in SB 1078.

Table 1: Estimated RPS Cumulative Additional Procurement Beyond Baseline and 2003 Interim Procurement for IOUs and ESP/CCA to meet SB 1078 Goals

	2005	2008	2017
Energy: GWh/year cumulative additions	2,540	8,840	21,200

Staff estimates that by 2017, California IOUs and ESP/CCAs will require an additional 21,200 GWh/year to meet the 20% target (as shown in Table 1). Staff notes that the renewable energy projects proposed in California in a variety of recent solicitations, totaling about 25,400 GWh/year, are sufficient in projected energy production to fully subscribe the 21,200 GWh/yr RPS demand (beyond estimated 2001 baseline and interim procurement) that we estimate for the IOUs and ESP/CCAs by 2017.

Staff estimates that California's RPS goal could be met using renewable energy resources based in California, without exhausting the remaining technical potential of these resources.[1] Staff calculated California's "remaining potential," (i.e., total potential less proposed and existing generation) for renewable energy at a total of about 167,500 GWh/year.[2] Staff estimates the remaining potential for wind at 16,670 GWh/year, geothermal at 31,220 GWh/year, biomass at 21,250 GWh/year, and solar at 98,360.[3] The remaining technical potential is over three times the demand staff calculates will be created by the RPS. The technical potential of the WECC (excluding California) is estimated to be almost 4 million GWh/year. This is more than 80 times staff's estimate of California's RPS demand for IOUs and ESP/CCAs (44,395 GWh/year).

I. Legislative Requirements for a Renewable Resource Assessment

SB 1078 established the California Renewables Portfolio Standard Program (RPS). The RPS sets forth the goal that 20% of electricity sold to California customers will be procured from eligible renewable energy resources by 2017.

SB 1038 requires the Energy Commission to complete a renewable resource plan and requires the California Public Utilities Commission (CPUC) to complete a renewable transmission plan. Both reports must be submitted to the Legislature by December 1, 2003, but the CPUC is directed to use the renewable resource plan in preparing its transmission plan. To facilitate coordination of these tasks, the Energy Commission has agreed to prepare a preliminary renewable resource assessment for 2005 and 2008 and to deliver it to the CPUC on July 1, 2003.

On January 29, 2003 the Energy Commission submitted a letter to the CPUC regarding the scope and schedule of a preliminary renewable assessment for 2005 and 2008 to be used for development of the CPUC's renewable energy transmission plan. This information is contained in the February 26, 2003 Administrative Law Judge Meg Gottstein's Ruling on Development of Renewables Transmission Plan Pursuant to Senate Bill 1038 (Proceeding I.00-11-001) and states in relevant part:

> The Preliminary Renewable Resource Assessment will assess a level of renewable development in 2005 and 2008 sufficient to allow Pacific Gas & Electric, Southern California Edison, San Diego Gas & Electric, and any other "obligated entities" to achieve the incremental Renewable Portfolio Standard (RPS) goals embodied in Senate Bill 1078 (Chapter 516, statutes of 2002). We will be providing an

[1] California-specific technical potential data used in this study comes in part from the Regional Economic Research, *Technical Potential of Renewable Resource Technologies*, published in June 2002.

[2] To determine "remaining potential" staff subtracted existing and proposed wind, geothermal, and biomass (i.e., forest/urban wood wastes, agricultural waste, landfill gas, digester gas, and municipal solid waste including tire waste facilities) facilities from the technical potential for California renewables estimated in the RER study.

[3] The RER report includes the following sources in technical potential for biomass: forest/urban wood wastes, agricultural waste, landfill gas, and digester gas.

opportunity for public input into the development of this renewable resource assessment, and we welcome the comments of the CPUC, the utilities, the CAISO and renewable developers. We will publish an initial draft of the assessment by early June and request public comment on the draft.

The resource assessment will provide renewable megawatt additions for the transmission plan's target years by technology type and by renewable resource locations, e.g., Tehachapi, Salton Sea, San Gorgonio, Altamont, and Siskiyou County. It will also include an analysis of renewable resource potential by technology type and location, as SB 1038 requires. This analysis will provide transmission planners with some basis for developing bounding cases for renewable resource development.

The Energy Commission held a Joint Committee Workshop in June 2003 to solicit public input from the CPUC, the utilities, the CAISO, renewable developers, and other interested parties regarding this preliminary renewable resource assessment. The Energy Commission's Ad hoc Integrated Energy Policy Report Committee and the Renewables Committee used information from this workshop, along with input from staff and technical consultants, to revise the Preliminary Renewable Resource Assessment for delivery to the CPUC on July 1, 2003.

This draft assessment permits a reconnaissance level analysis of current and potential transmission constraints. New information may become available after July that may alter the assumptions used in this draft assessment. An accelerated RPS scenario to achieve 20% of retail sales by 2010 and any new or updated information will be included in the Renewable Resource Development Report. The Energy Commission staff will continue to collaborate with the CPUC staff after July 1, so that both the Energy Commission's renewable resource plan and the CPUC's renewable transmission plan remain as coordinated as possible as they are developing.

II. Study Methods, Findings and Estimate of RPS Requirements

Note: The assumptions used in this draft assessment should in no way be construed to represent the position to be taken by the CPUC or CEC on decisions yet to be made in the RPS proceedings that are currently underway.

This preliminary renewable resource assessment compares the Energy Commission's estimated need for additional renewable energy resources with potential supply to meet the RPS obligations of "retail sellers," that is, the obligated investor owned utilities (IOUs), electric service providers and community choice aggregators (ESP/CCAs). The IOUs included in this analysis are Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E).

This study provides preliminary analysis and research results of several different aspects of renewable energy resource demand and supply, including:

1) **Estimated Additional Renewables Needed to Meet California's RPS:** Staff estimated the additional renewable energy resources that will be needed to meet California's RPS requirement by 2017. This estimate was based on forecasted retail sales for IOUs and ESP/CCAs and publicly available information regarding existing renewable resources and interim procurement of renewable energy for 2003.
2) **Empirical Data of Existing and Proposed Renewable Projects**: This preliminary assessment summarizes empirical data on existing and proposed renewable generation in California and throughout the states of the Western Electricity Coordinating Council (WECC) to identify resource areas and estimate quantities of renewable energy resources that may be available in the near term to serve California's RPS-related demand.
3) **Technical Potential of Renewable Energy**: This assessment summarizes publicly available data on the renewable energy resource technical potential in California and throughout the WECC to identify resource areas and estimate quantities of renewable energy resources that may be available in the longer term to serve California RPS-related demand.
4) **Plausible RPS compliance scenario**: To facilitate transmission planning, a preliminary plausible scenario for development of renewable resources to meet California's RPS in 2005, 2008, and 2017 was prepared. This scenario reflects recent trends in the mix of renewable electric generation resources (e.g., wind, geothermal, biomass, and solar) in California.

While the analysis presented in this preliminary report contains data on the entire WECC, it emphasizes the renewable energy resources located within California. Preliminary data regarding the technical potential for renewable energy development in other WECC states suggest that California could import much of its RPS energy, depending on the market bidding process and rules that will be established by the CPUC and the Energy Commission by the end of 2003 regarding out-of-state participation, flexible compliance, and renewable energy credits. The role of other WECC states in meeting California's RPS will be determined by the CPUC and CEC in the RPS proceedings currently underway and will be discussed more thoroughly in the Renewable Resources Development Report.

The remainder of this preliminary renewable resource assessment describes the process and data used to derive a plausible renewable development scenario. First, the report provides an estimate of retail sales, and estimates of annual RPS energy required. Second, the report summarizes publicly available information regarding existing, proposed, and potential renewable energy resources in California and the WECC. Third, the report explains the process used to identify a preliminary scenario of the future technology mix that may be used to meet RPS. Fourth, the report presents the estimated RPS additional procurement for IOUs and ESP/CCAs. Fifth, the report presents a plausible scenario of renewable energy development to meet SB 1078 goals by 2017. The data included here and in the accompanying appendices have been prepared to serve as the initial basis for the SB 1038 CPUC transmission study.

A. Estimate of Retail Sales

In developing this assessment, the Energy Commission Staff (Staff) estimated the annual RPS energy requirements for each year from 2003 through 2017, for each IOU individually and the ESP/CCA load in aggregate within the IOU's service territories. In calculating these estimates, the Energy Commission is in no way prejudging the CPUC's ultimate decision on issues related to RPS need or targets.

To quantify the annual requirements for this goal, this study uses *Staff's Outlook for California - Retail Sales by Utility (GWh)* to identify forecasted retail sales for the IOUs, the ESPs/CCAs in aggregate and the rest of the state.[4] Once the total 2001 sales were estimated, Staff estimated the 2001 qualifying energy that came from renewable resources. This served as an estimate of the 2001 baseline for RPS compliance. For each of the retail sellers, the estimated baseline amount of RPS qualifying renewable energy in 2001 was divided by the associated retail sales in 2001 to produce the 2001 baseline as a percent of associated retail sales. See Appendix A for details regarding the preparation of the retail sales forecast.

Under the CPUC's Interim Procurement ruling D.02-08-071, each of the three IOUs were ordered to procure at least an additional one-percent of their 2001 retail energy sales from qualifying renewable resources, for delivery in 2003 and beyond. The IOUs subsequently prepared and held solicitations, resulting in 826 GWh/year for PG&E and at least 748 GWh/year for SCE. For SDG&E, the interim procurement resulted in the equivalent of 4.5% of retail sales in 2003 (545 GWh) and a cumulative total of 7.1% by 2004 (an additional 405 GWh beyond 2003, bringing the cumulative total to 950 GWh) coming from eligible renewable resources. This analysis assumes that the Interim Procurement satisfies the IOUs' 2003 RPS obligation, as well as subsequent years' obligations, if applicable. However, the Energy Commission understands that some of the Interim Procurement may be RPS eligible only for baseline adjustment. For this study, results from the Interim Procurement are assumed to be maintained through 2017. This analysis also assumes that the ESP/CCAs procured enough energy in 2003 to meet their one-percentage point growth under SB 1078.

B. Estimate of RPS Requirements

Table 1 identifies the estimated additional procurement of renewable energy needed to achieve the RPS goals set out in SB 1078 (RPS demand). The amounts shown in Table 1 must be added to staff's estimation of the 2001 baseline and publicly available information regarding the 2003 interim procurement to reach 20% of retail sales forecasted for IOUs and ESP/CCAs (obligated entities) in 2017.

[4] *Staff's Outlook for California - Retail Sales by Utility (GWh)* was prepared by Energy Commission Staff in the Demand Analysis Office. The table used for this analysis is included in Appendix A and will be available July 25th http://www.energy.ca.gov/energypolicy/documents/index.html .

Table 1. Estimated RPS Cumulative Additional Procurement Beyond Baseline and 2003 Interim Procurement for IOUs and ESP/CCAs to meet SB 1078 goals

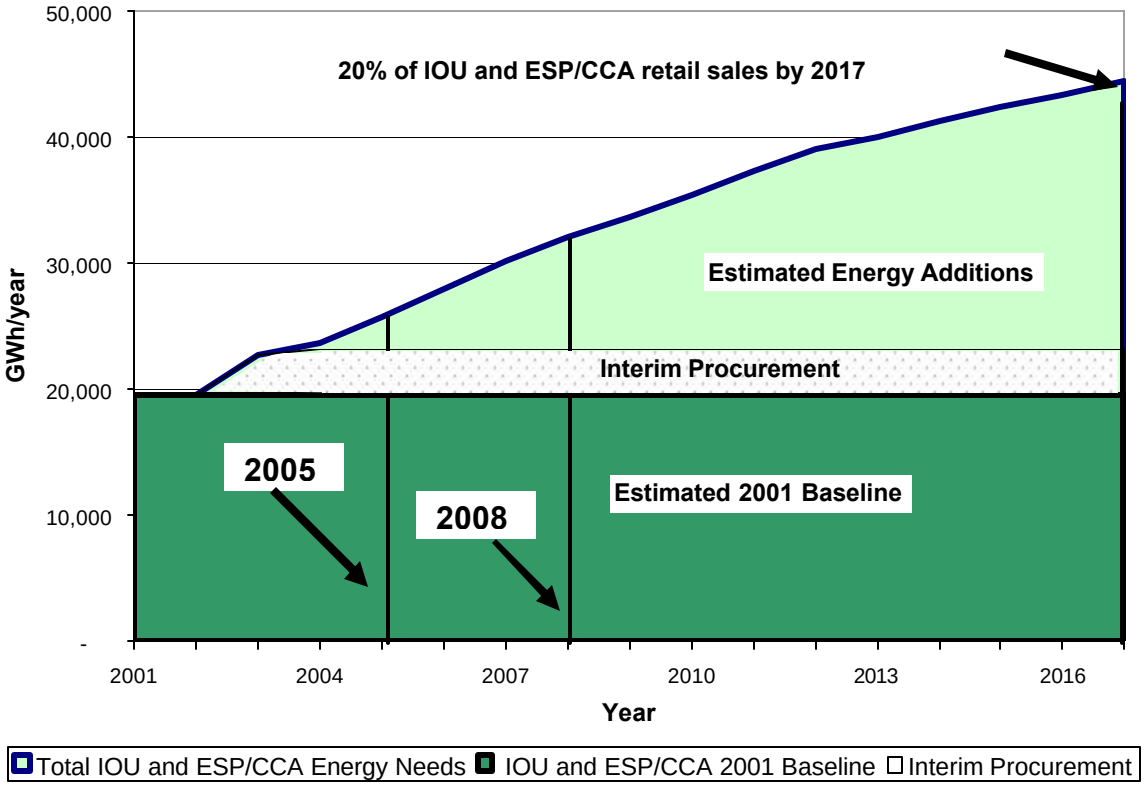
	2005	2008	2017
Energy: GWh/year cumulative additions	2,540	8,840	21,200

For the years 2004 to 2017, Staff took a literal interpretation of SB 1078 in determining how much energy the obligated entities would be required to procure each year. In calculating the one-percent increase per year, Staff used an estimation of 2001 baseline energy. Beginning in 2003 for the ESP/CCAs and 2004 for the IOUs, Staff calculated growth of one percentage point each year until the 20% target is met (10% to 11% to 12%, and so on). After the target is met, staff estimates show that it is maintained. If any of the obligated entities do not reach the 20% target by 2017 with an annual one-percentage point growth rate, they must grow at a rate proportionately higher to reach the 20% target. The trajectory created by these calculations establishes an estimate of the Annual Procurement Target (APT).

This analysis is designed to estimate the amounts of additional renewable energy required to meet the RPS goals in each year, with an emphasis on the years 2005 and 2008. The analysis includes no attempt to model flexible compliance with the RPS requirements, where the required energy could be procured prior to or after the actual year it is required to meet the APT. Flexible compliance does not change the total amount of additional energy required to meet the RPS, but it is likely to affect the timing. This analysis also assumes that the amount of energy identified in the estimated 2001 baseline continues to be procured each year by the same retail seller and at the same amount as in 2001. In fact, the amount of baseline energy procured each year could decline or increase, or could shift among retail sellers. These effects are not included here. A decline in baseline energy procured would require additional energy to meet the RPS goals; a shift in baseline resources among retail sellers could shift the nature or location of procurement for the RPS.

Figure 1 illustrates Staff's estimated baseline, 2003 Interim Procurement, and the additional renewable energy that will be required to meet RPS.

Figure 1. Estimated Renewable Energy Baseline, 2003 Interim Procurement and IOU, ESP/CCA Additions to meet California's RPS Requirements



The estimated 2001 baseline is the starting point towards RPS compliance for the IOUs and ESP/CCAs. The additional renewable energy procured by the IOUs during the 2003 Interim Procurement represents a portion of the amount of additional energy that the obligated entities need to procure to meet the RPS goal by 2017. This analysis assumes that the ESP/CCAs procured a net increase of one-percent of their retail sales in 2003. With this assumption, the IOUs and ESP/CCAs will need to procure an additional 21,200 GWh/year of renewable energy to reach the RPS mandated goal of 20%, by 2017.

Table 2 shows the estimated additional Gigawatt hours of electricity needed to meet IOU and ESP/CCA obligations under the RPS by service territory. These values are in addition to the estimated 2001 baseline energy and the annual generation from the Interim Procurement to reach 20% of IOU and ESP/CCA retail sales by 2017.

Table 2. Estimated RPS Additional Procurement Beyond Baseline and 2003 Interim Procurement for IOUs and ESP/CCAs (Cumulative GWh/year) by Service Territory

	2005	2008	2017
PG&E			
Utility	1,253	4,169	9,521
ESP/CCA	188	489	1,314
SCE			
Utility	756	2,965	5,123
ESP/CCA	259	677	1,873
SDG&E			
Utility	0	319	2,721
ESP/CCA	84	223	650
Total NEW			
Utility	2,009	7,453	17,365
ESP/CCA	531	1,389	3,837
	2,540	**8,840***	**21,200***

*Due to rounding, data do not add to total

Details regarding this estimate of RPS requirements are provided in Appendix A.

1. Estimate of RPS Energy Requirements by IOU

a. PG&E

Staff forecasted the amount of energy that PG&E would sell from 2003 through 2013. This forecast has an annual, average growth rate for this time period of 1.7%. This same rate was applied by Staff to calculate sales figures for 2014 to 2017.

Staff's estimated sales data for PG&E for 2001 are slightly different than data that PG&E provided to the CPUC in a January 6, 2003 (R.01-10-024) filing. For 2001, Staff estimated that PG&E sold 75,681 GWh.

In a January 6, 2003 (R. 01-10-024) filing, PG&E calculated their 2001 percentage of power provided by eligible renewable power sources to be 10 percent of their total energy portfolio. Staff converted this total into energy, and used it for the energy figure. However, Staff used the Energy Commission's sales figure when calculating the percent of sales. For 2001, Staff estimated that PG&E sold 7,532 GWh of eligible renewable energy.

In their Advice letter dated January 2, 2003 (2334-E), PG&E indicated they would procure approximately 826 GWh/year beginning in 2003 for their Interim Procurement requirement.

In addition to their estimated 2001 baseline and estimated 2003 Interim Procurement, Staff calculated that PG&E will need to procure an additional 1,253 GWh/ year by 2005, 4,169 GWh/year by 2008 and 9,521 GWh/year by 2017 to meet their RPS obligations. Staff estimates that PG&E will meet its 20% target by 2013. Subsequent procurement is not at 1% a year, but maintains 20% of retail sales.

b. SCE

Staff forecasted the amount of electricity that SCE would sell from 2003 through 2013. This forecast had an annual, average growth rate for this time period of 1.8%. This same rate was applied by Staff to calculate sales figures for 2014 to 2017.

Staff's 2001 sales data for SCE are slightly different than data SCE provided to the CPUC in a January 2, 2003 (R.01-10-024) filing. For 2001, Staff estimated that SCE sold 74,286 GWh.

In a U-338 E filing on January 6, 2003 (R. 01-10-024), SCE indicates that their Renewable QFs in 2001 provided 10,610 GWh. Based on an analysis of SCE's FERC Form No. 1 data, Staff added an additional 550 GWh of small hydroelectric generation that potentially was not counted by SCE, but may qualify as part of SCE's 2001 renewable baseline. For 2001, Staff estimated that SCE sold 11,160 GWh of eligible renewable energy.

In a January 2, 2003 filing, SCE indicated they would procure at least 748 GWh/year beginning in 2003 for their Interim Procurement requirement.

In addition to their estimated 2001 baseline and their estimated 2003 Interim Procurements, Staff calculated that SCE will need to procure an additional 756 GWh/year by 2005, 2,965 GWh/year by 2008 and 5,123 GWh/year by 2017. Staff estimates that SCE reaches 20% by 2007. Subsequent procurement is not at 1% a year, but maintains 20% of retail sales.

c. SDG&E

Staff forecasted the amount of energy SDG&E would sell from 2003 through 2013. This forecast had an annual, average growth rate for this time period of 1.9%. This same rate was applied by Staff to calculate sales figures for 2014 to 2017.

Staff estimated sales data for SDG&E for 2001 to be 15,000 GWh/year. Per a January 2, 2003 filing (R.01-10-024), SDG&E considers their 2001 sales to be confidential.

In a January 6, 2003 filing (R. 01-10-024), SDG&E indicates that their renewable energy sales in 2003 will be 4.5% and 7.1% of total retail sales in 2004. Also, SDG&E indicates that for 2003, 3.76% of the 4.5% will be additional renewable energy, per the Interim Procurement requirement. Staff subtracted percentages across the years of this study, and assumed that in 2001, SDG&E had 0.74% of their total sales come from renewable energy

resources. In terms of energy, for 2001 Staff estimated that SDG&E sold 112 GWh of eligible renewable energy.[5]

Staff estimate that SDG&E will not need to procure any additional renewable energy in 2005 beyond what is already in its estimated 2001 baseline and what will be delivered under contracts signed during the Interim Procurement process. SDG&E will need to procure 319 GWh/year by 2008 and 2,721 GWh/year by 2017. Staff estimates that SDG&E will only reach 20% by 2017 if, on average, SDG&E procures 245 GWh/year between 2003 and 2017.

2. Estimate of ESP/CCA RPS Energy Requirements by IOU Service Territory

SB 1078 requires that IOUs and ESP/CCA providers ensure that 20% of their renewable energy sales come from eligible renewable resources by 2017. Rather than look at the amount that each individual Direct Access company sells, this analysis looks at the service territories into which those providers sell electricity.

Staff forecasted the amount of electricity that the ESPs/CCAs would sell between 2003 and 2013 by service territory. The retail sales forecast shows an average growth rate of 1.3% (PG&E), 1.6% (SCE), and 2.2% (SDG&E) between 2003 and 2013. These percentages were used to extrapolate estimated retail sales for 2014-2017. It is important to note that while the amount of energy sold by ESPs/CCAs increased, the percentage in relation to IOU sales remained roughly constant.

Staff estimated ESPs/CCA sales for 2001 to be 10,392 GWh. This figure includes supply from renewable and non-renewable energy resources. To calculate the portion of 2001 ESP/CCA sales that came from renewable energy resources, Staff used information from the Energy Commission's Customer Credit account. This Program provided "Customer Credits" to consumers who purchased eligible renewable electricity from electric service providers that were registered with the Energy Commission. Through this program, consumers choosing renewable or "green power" could receive payment for up to 1.0 cents per kilowatt-hour of renewable electricity purchased in 2001.

For 2001, Staff estimates that there were 745 GWh of eligible renewable sales for the ESP/CCAs (Direct Access providers). This is the amount of renewable energy sales eligible for Customer Credits and that received payment from the Energy Commission in 2001. Staff believes this is a conservative estimate of actual ESP/CCA renewable sales. Determining the IOU service territory where the recipients of the eligible renewable energy resided is not possible with the current publicly available data. Therefore, Staff assumed that ESP/CCAs had the same percentage of eligible renewable sales. This value was derived by taking the total estimated ESP/CCA renewable sales, 745 GWh, and dividing that by the total amount of Direct Access sales in 2001, 10,392 GWh. Therefore, for this analysis, the estimated 2001 ESP/CCA renewable baseline is 7.17% for all ESP/CCAs. In terms of total load in 2001, the

[5] Staff recognizes that this approach is problematic from a mathematical standpoint, but believes that any error introduced by this approach is small.

10,392 GWh of aggregate ESP/CCA load is split among utility service territories as follows: 3,761 GWh for PG&E; 4,168 GWh for SCE; and 2,463 GWh for SDG&E. These ESP/CCA estimates are slightly different than data reported by the IOUs in some of their CPUC filings. It is likely that some of this load has reverted back to the IOUs.

In addition to their 2001 estimated baseline and assumed 2003 procurement under SB 1078, Staff estimates that ESP/CCA providers will need to procure an additional 531 GWh/year by 2005, 1,389 GWh/year by 2008 and 3,837 GWh/year by 2017 to meet RPS requirements. Staff estimates that ESP/CCAs reach their requirements by 2015. Subsequent procurement is not at 1% a year, but maintains 20% of retail sales.

III. Existing, Proposed, and Potential Renewable Energy Generation in California and the WECC

Empirical data were gathered on specific existing and proposed renewable generation facilities in California and across the states of the Western Electricity Coordinating Council. Data on existing resources were gathered from three sources: the Energy Commission's Existing Renewable Facilities Program database, the Energy Commission's New Renewable Resources Account database and the U.S. DOE Energy Efficiency and Renewable Energy (EERE) database, which is called the Renewable Electric Plant Information System (REPiS). For California data, biomass includes digester gas, landfill gas, and municipal solid waste (including tire waste facilities).

Data on proposed projects were gathered from solicitations for new renewable electricity providers to IOU and/or municipal electric utilities. The following data sources were used: the Energy Commission's New Renewable Resources Account database, California Power Authority Letters of Intent, Southern California Public Power Authority (SCPPA) Request for Proposals (RFP), Bonneville Power Authority (BPA) Transmission Information database (OASIS), the Sierra Pacific RFP, Foresight Energy's ongoing review of press releases and other data sources. Data for proposed projects within California rely on publicly available information from the sources listed above and the IOU Interim Procurements. The data exclude information from the NCPA solicitation. This information will be updated for the Renewable Resource Development Report.

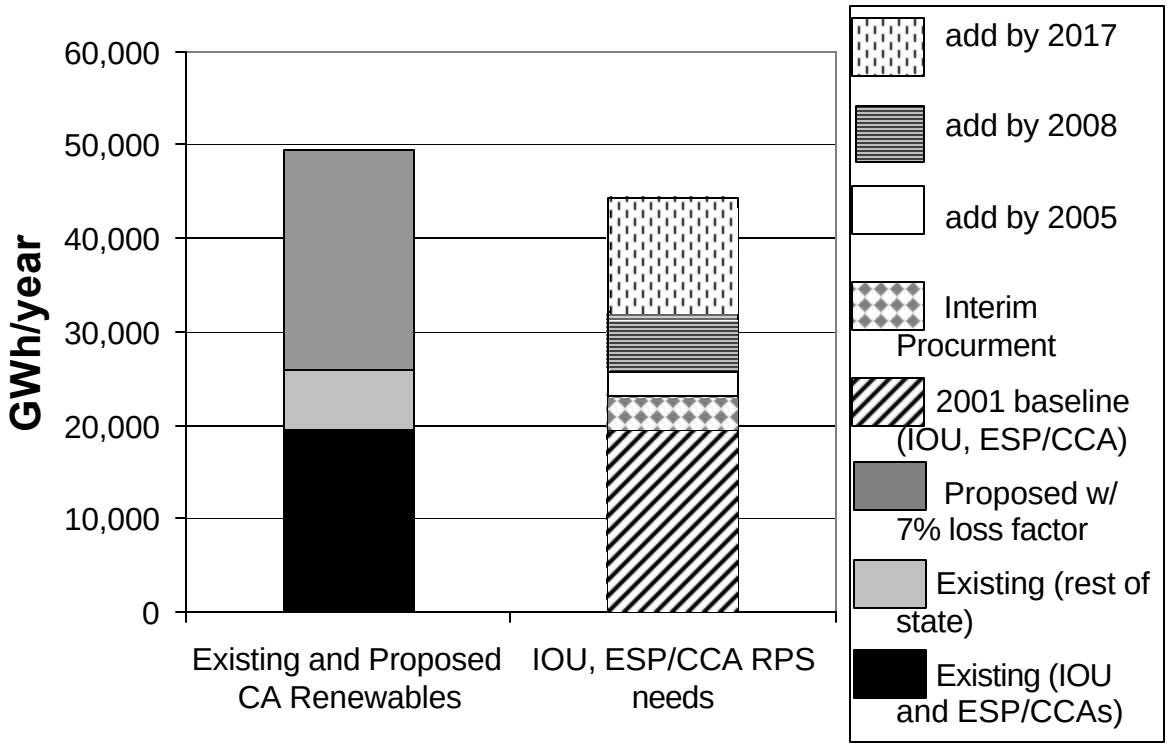
Due to limited access to data at the time this study was prepared, information provided herein for existing and proposed projects in WECC states outside of California is not comprehensive. For Washington and Oregon the data was collected from BPA OASIS. For Nevada, data was collected from their recent solicitation for renewable energy. The data does not include the Montana wind solicitation, nor does it include the Colorado all-source solicitation from several years ago. We have also not looked at OASIS sites outside of BPA. For this reason, data regarding WECC states other than California is suggestive only, especially for outer-tier WECC states. For WECC states outside of California, biomass data includes landfill gas, crop and forest residue, and animal waste.

In this analysis we reviewed publicly available information regarding the technology mix of existing and proposed projects. The renewable technologies primarily represented in these solicitations are wind, geothermal, and biomass (including landfill gas). While solar thermal, photovoltaic and other renewable technologies will likely participate in future solicitations, they are not well represented in the empirical data sets examined here. The actual technology mix used to meet RPS requirements will be determined through a bid solicitation process according to rules under development at the CPUC and CEC.

Available data suggest that proposed renewable projects in California roughly match the estimated additional renewable energy that will be required to meet RPS requirements in 2017. However, rules to be established by the Energy Commission and the CPUC regarding out-of-state participation may create the possibility that eligible out-of-state supply will bid and win solicitations to satisfy some of the RPS demand. Over time this could have a large impact on the location of renewable energy facilities used to meet the RPS. The technical potential for wind in each of several other WECC states dwarfs California's wind potential by an order of magnitude. In addition, abutting states have significant wind, geothermal, biomass, and solar resources that are comparable in scale to the technical potential in California. However, for this analysis, Staff assumed that all of the generation required to meet RPS demand in 2005, 2008, and 2017 is located within California.

California has a plentiful supply of renewable energy resources. Proposed additional projects (about 25,400 GWh/year) roughly match the estimated additional renewable energy that will be required to meet RPS requirements by 2017 (21,200 GWh/year). However, some of the proposed additional projects may receive contracts from municipal electric utilities or sell some or all of their energy or renewable energy attributes out of state and therefore may not be available to meet California IOU or ESP/CCA RPS requirements. Moreover, not all of the proposed projects will realistically be able to achieve commercial operations. Some screening was done in compiling the data for proposed projects to include only the projects with substantial preliminary application processes underway. Assuming that all of the proposed projects that passed this filter are available to meet IOU and ESP/CCA RPS requirements, Figure 2 compares existing and proposed in-state renewable projects (wind, geothermal, biomass, and solar) with the estimated RPS requirement for 2017 (i.e., 20% of forecasted retail sales for IOUs, ESP/CCAs). Available data from the Interim Procurement is shown with RPS need. This includes publicly available data regarding IOU procurements and an assumed level of ESP/CCA procurement.

Figure 2. California's Existing and Proposed Renewable Energy in Comparison to Estimated RPS Requirements



Regarding the amount of energy sold by existing renewable energy facilities in California (IOU, ESP/CCA, and "rest of state"), Staff estimates that there were 27,759 GWh generated by qualifying renewable electric facilities in California in 2001. This renewable generation was sold to IOUs, ESP/CCAs, publicly owned electric utilities and out-of-state customers. Much of the current renewable energy sold to ESP/CCAs, publicly owned electric utilities and to out-of-state customers is under contract and is not immediately available to meet the IOUs RPS obligations.

It is important to note that this analysis converted existing renewable generation to sales using a 7% generation loss. Hence, the amount of generated energy delivered to retail sales from existing energy facilities (IOU, ESP/CCA and "rest of state") rounds to 26,000 GWh/year (i.e., 93% of 27,759 GWh). In Figure 2, the amount shown as "proposed" renewable energy generation (about 23,620 GWh/year) was calculated using a 7% loss factor (93% of 25,397 GWh/year). All other data shown in Figure 2 are based on estimates of retail sales.

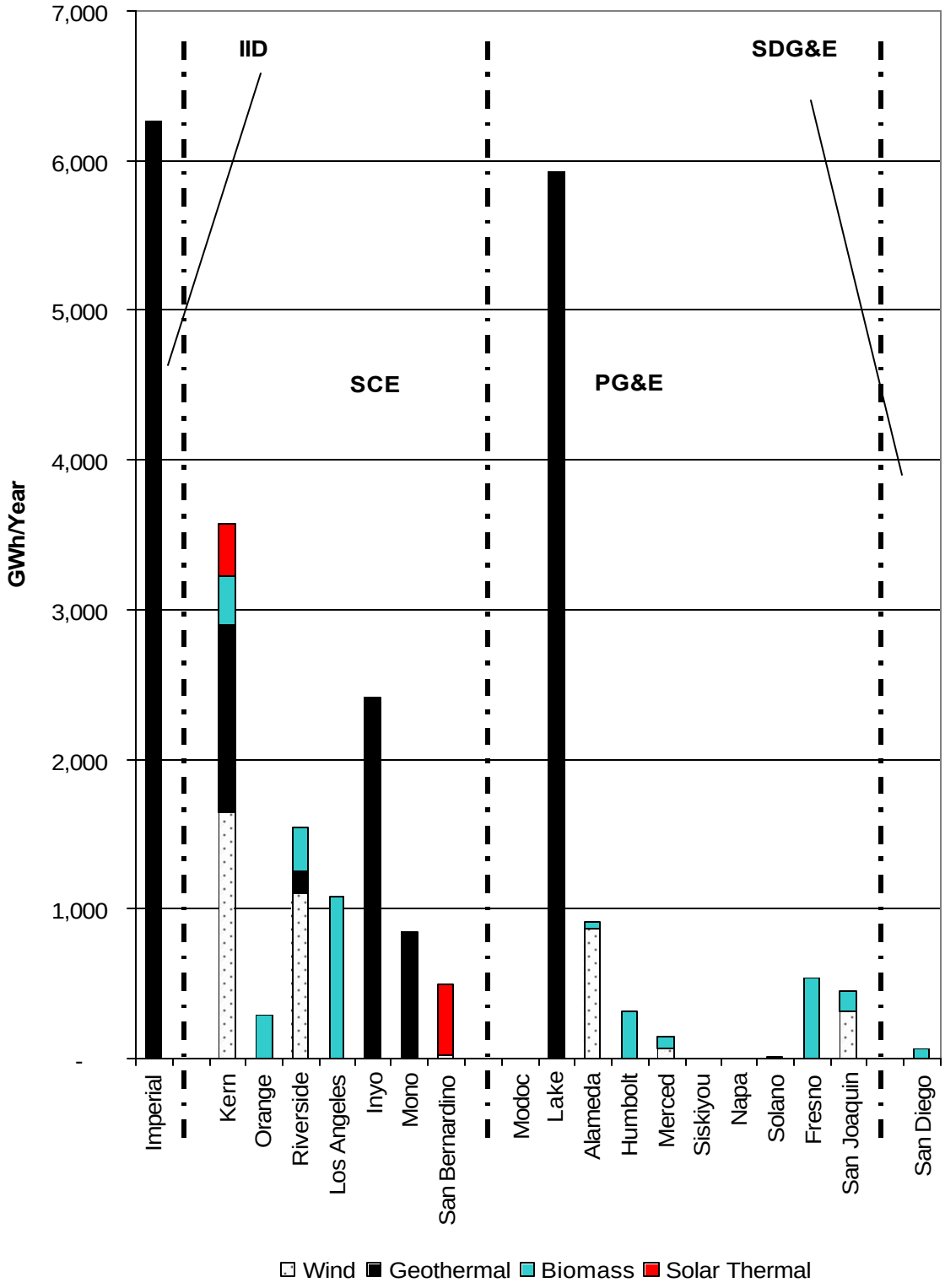
A. Existing Renewable Energy in California

Data on existing resources were gathered from three sources: the Energy Commission's Existing Renewable Facilities Program database, the New Renewable Resources Account

database and the U.S. DOE Energy Efficiency and Renewable Energy (EERE) database (also known as the Renewable Electric Plant Information System or REPiS). Assumed capacity factors for converting from MW to GWh/year for existing facilities were 25% for wind, 90% for geothermal, 71% for biomass, and 27% for solar thermal.

Figure 3 shows the amount of electricity produced by existing renewable energy facilities in the top 19 California counties and utility in which the renewable energy resource is geographically located (as opposed to the location of the purchaser of the energy).

Figure 3. Electricity Produced from Existing Renewable Energy Resources in California's Top 19 Counties (by service territory)



B. Existing Renewable Energy in Other WECC States

The Western Electricity Coordinating Council (WECC) consists of 11 Western states, portions of western Canada and a section of Baja California, Mexico that is adjacent to California. Staff divided the WECC members into three categories: 1) California, adjacent states (Oregon, Nevada, Arizona), and Washington; 2) outer tier states (i.e., Montana, Idaho, Wyoming, Utah, Colorado, New Mexico; and 3) international WECC members. This division of WECC members is intended to match the transmission and RPS rule-making issues associated with transporting electricity from adjacent, non-adjacent, and international WECC members.

Figure 4 shows existing wind, biomass and geothermal energy facilities in Washington and WECC states that are adjacent to California (i.e., Oregon, Nevada, and Arizona). Data is for 2001 for biomass and geothermal and 2002 for wind. Figure 4 shows that about 7,000 GWh/year was generated in Washington and WECC states adjacent to California from wind biomass and geothermal energy facilities. Existing solar energy facilities are shown together with proposed and potential solar energy in Table 3 at the end of this section.

Figure 4. Existing Renewable Energy Resources in Washington and WECC states adjacent to California (wind, geothermal, and biomass)

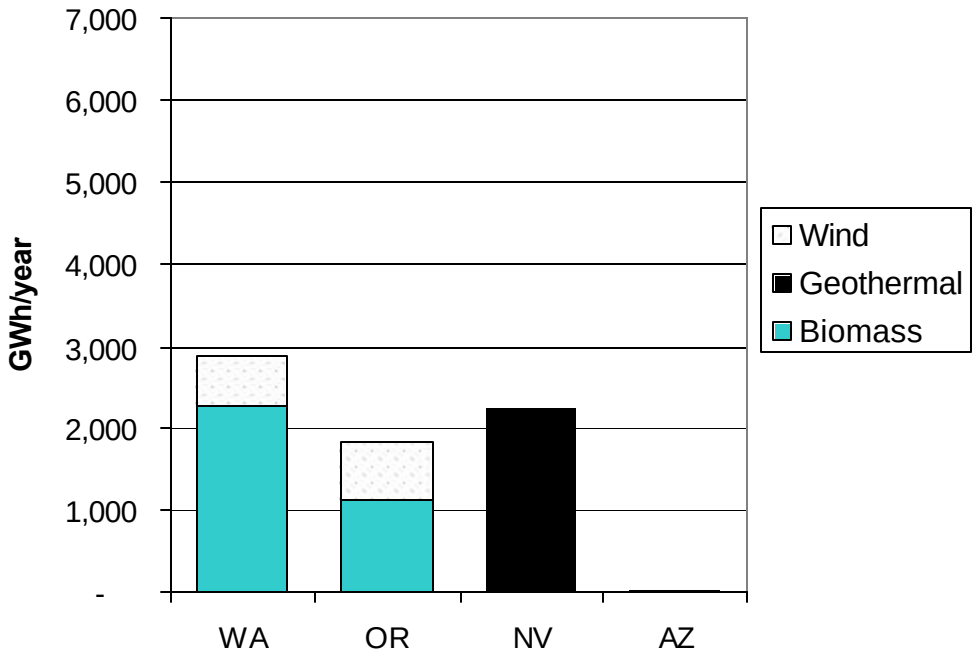


Figure 5. Existing Renewable Energy Resources in WECC Outer Tier states (wind, geothermal, and biomass)

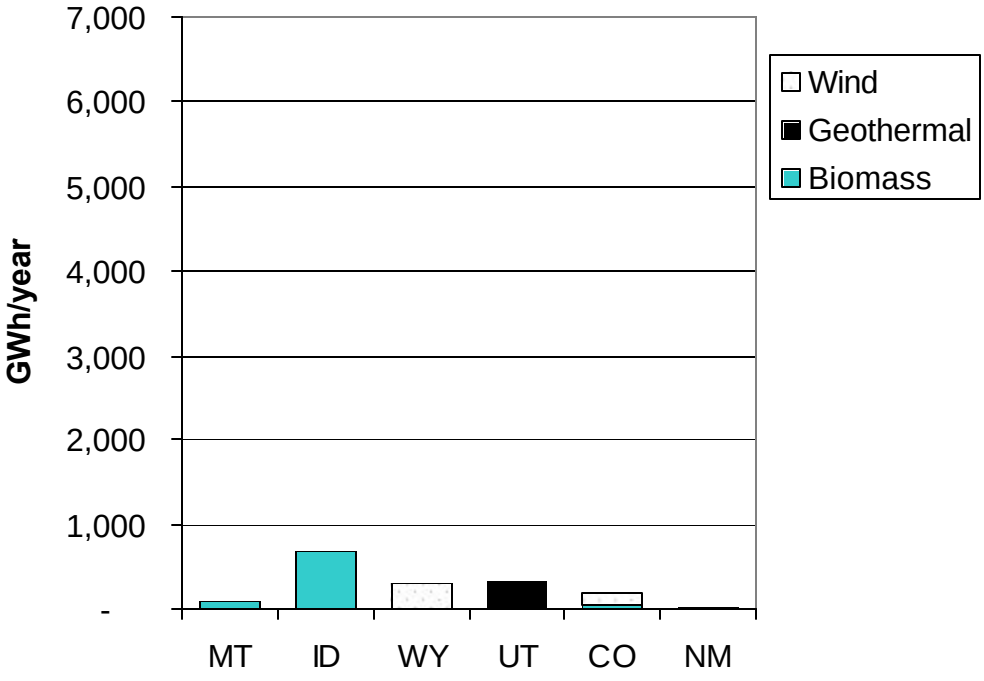


Figure 5 shows existing wind, geothermal, and biomass energy facilities in outer tier WECC states (i.e., Montana, Idaho, Wyoming, Utah, Colorado, and New Mexico). Figure 5 shows that about 1,600 GWh/year is generated in these states from these renewable resources.

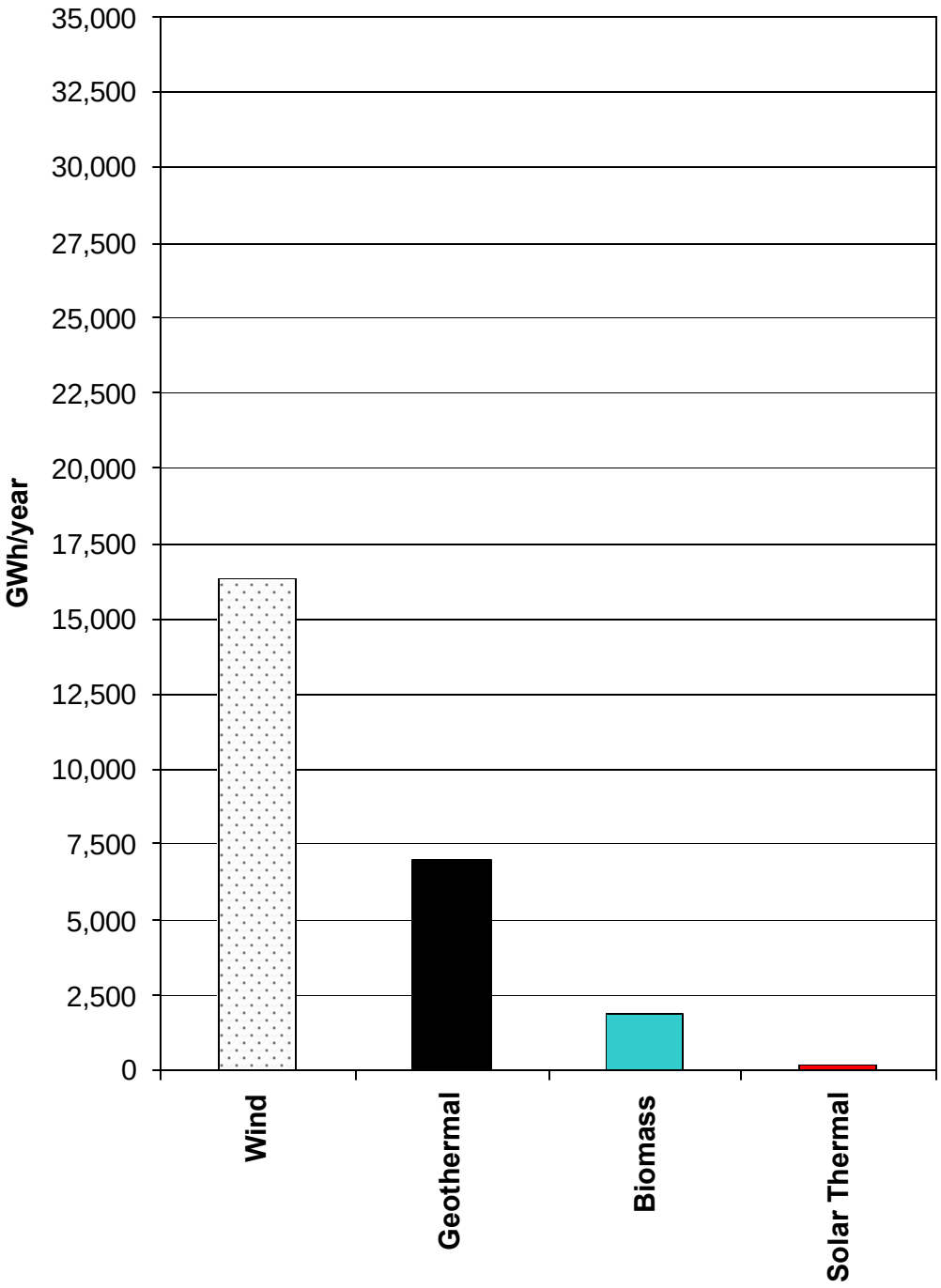
C. Proposed Renewable Energy Projects in California

Data on proposed projects were gathered from solicitations for new electric providers to IOU and/or municipal electric utilities. The following data sources were used: the Energy Commission's New Renewable Resources Account database, California Power Authority Letters of Intent, Southern California Public Power Authority (SCPPA) Request for Proposals (RFP), Bonneville Power Authority (BPA) Transmission Information database (OASIS), the Sierra Pacific RFP, and Foresight Energy's ongoing review of press releases and other data sources. Data for proposed projects within California rely on publicly available information from the IOU Interim Procurements and exclude information from the NCPA solicitation. This information will be updated for the Renewable Resource Development Report.

Figure 6 shows that additional wind, geothermal, biomass and solar thermal resources proposed for construction or repowering in California are expected to generate about than 25,400 GWh/year. These proposals have been offered through solicitations to meet the electricity needs of IOUs, ESPs/CCAs, and Publicly Owned Electric Utilities. A large proportion of the energy that would be derived from these proposed additional projects would be provided by wind turbines.[6]

[6] This figure could be conservative as data from recent solicitations was not included in the analysis.

Figure 6. Proposed Additional CA Renewable Generation by Technology



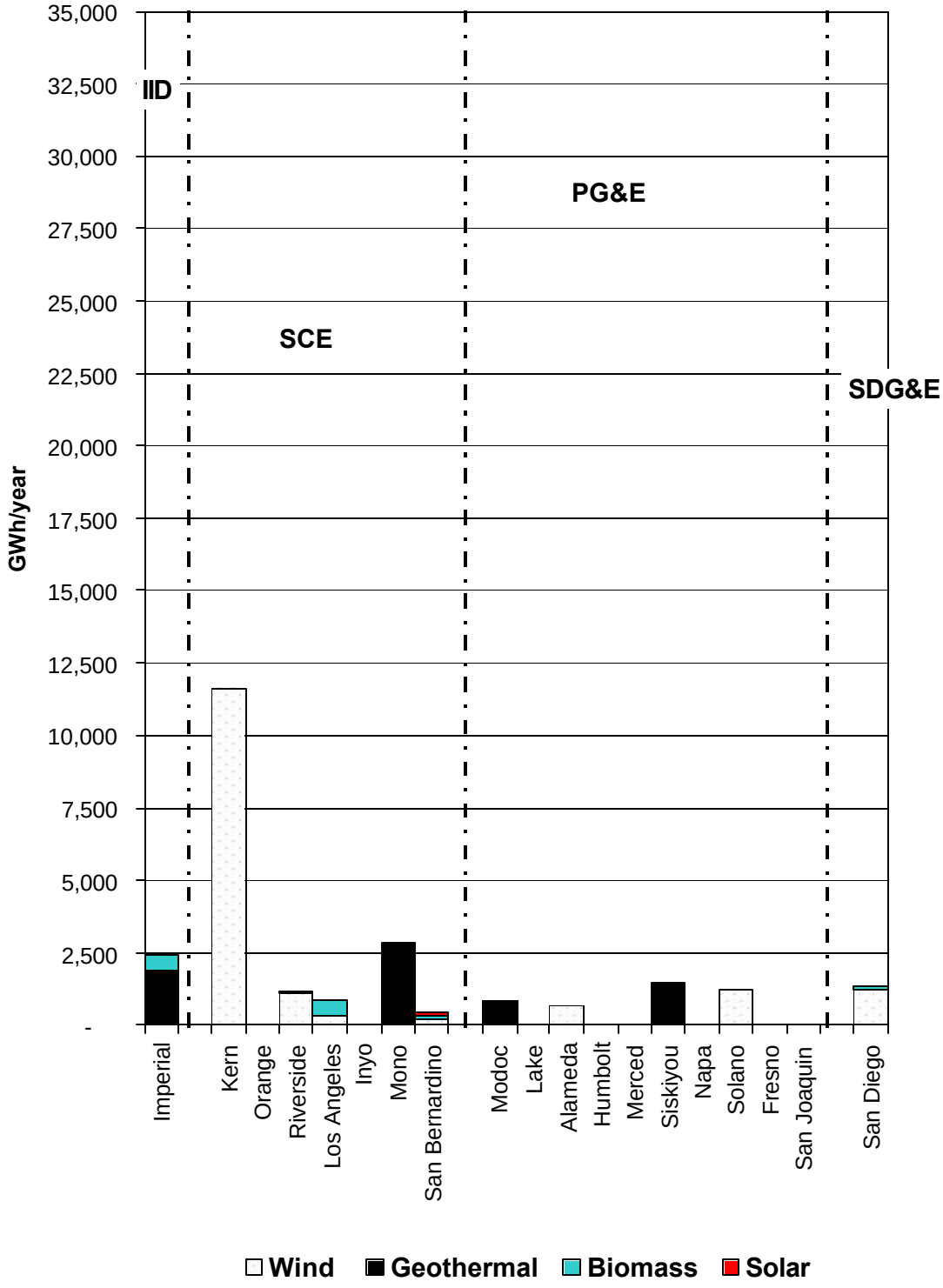
Some of these proposed projects may sell all or some of their electricity to publicly owned electric utilities (POEUs) to meet the POEU RPS goal, other retail sellers not subject to CPUC jurisdiction, or out of state. Staff estimates the RPS goal for the rest of the state (i.e., not PGE, SCE, SDG&E or ESP/CCAs) to be 9,400 GWh/year by 2017 beyond estimated 2001 baseline (6,270 GWh/year) and estimated interim procurement (910 GWh/year). Other WECC states with RPS programs are Nevada, Arizona, and New Mexico.[7]

Figure 7 displays proposed projects in California by resource type and county. The counties are organized according to the IOU service area in which they are physically located. Renewable energy produced by facilities constructed in these locations may actually sell their energy to a different entity. The actual allocation of energy will be determined through a bid solicitation process in accordance with rules established by the CPUC and the Energy Commission.

Comparing the proposed generation resources from among the top renewable energy resource counties in California, Kern County, home to the Tehachapi wind resource, is far above any other county.

[7] See Database of State Incentives for Renewable Energy (DSIRE): Incentives by State. Available online at www.dsireusa.org. Accessed 4/18/03.

Figure 7. Proposed Renewable Generation in California's Top 19 Counties (by service territory)



D. Proposed Renewable Energy Projects in Other WECC States

California's renewable energy resources are the most developed in the WECC to date as measured by the ratio of plants proposed and online to technical potential. Oregon and Washington are showing high levels of development activity as measured by the quantity of proposed generation (See Figure 8). Over 50,000 GWh/year of primarily wind energy have been proposed in Washington and WECC states adjacent to California. Publicly available information on proposed projects surveyed for this study indicates that outer tier WECC states have lower levels of development activity (See Figure 9). According to data available for this study, facilities expected to generate less than 6,200 GWh/year have been proposed in outer tier WECC states, suggesting that development of renewable energy in the outer tier is proceeding less quickly than development in the inner tier states. Wind energy dominates proposed additional renewable energy facilities throughout the WECC region. Proposed solar energy facilities are shown together with existing and potential solar energy in Table 3 at the end of this section.

Figure 8. Proposed Renewable Energy Resources in WA and WECC states adjacent to CA (wind, geothermal, and biomass)

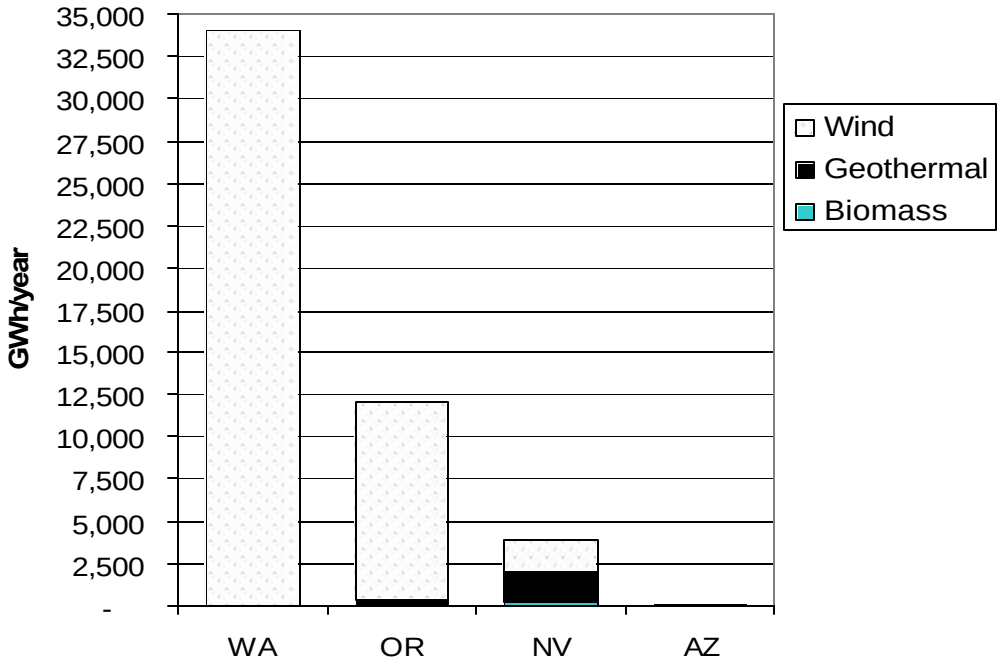
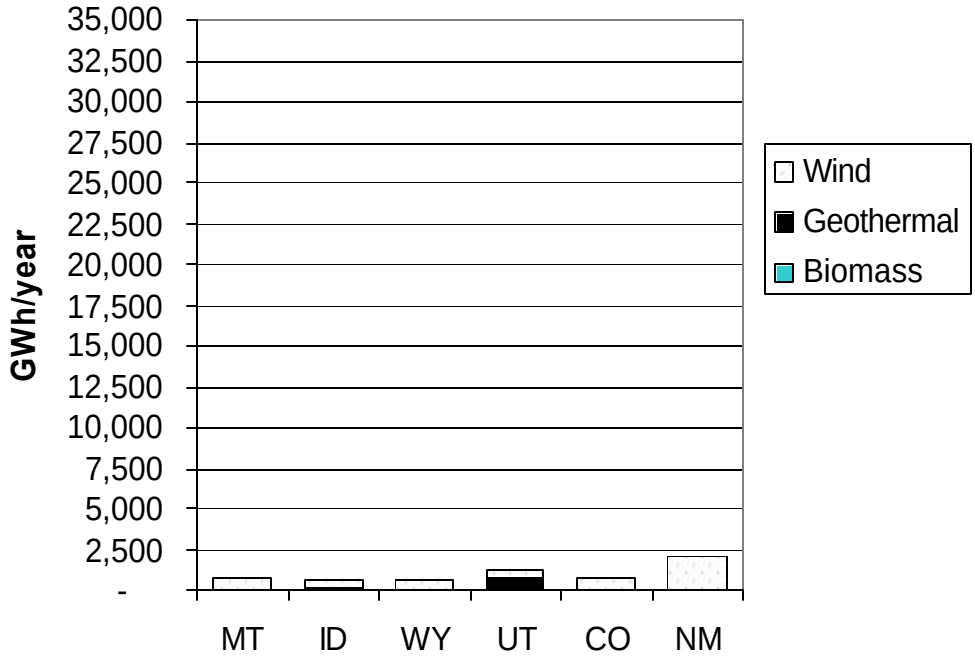


Figure 9. Proposed Renewable Energy Resources in WECC Outer Tier states (wind, geothermal, and biomass)



Experience with formal renewable solicitations indicates that developer responses often provide potential supply of five to ten times the amount solicited. This provides evidence that near-term supply for RPS demand will not be constrained.

Only 20% of the proposed projects reviewed for this study responding to auctions and RFPs were judged to be redundant. Redundant projects were excluded from the analysis. This suggests that a significant number of new proposed projects are entering the queue each year in California and the WECC states.

E. Remaining Technical Potential in California and other WECC states

Research funded by the Energy Commission is underway to update the technical potential for renewable energy in California. This information will be forwarded to the CPUC and incorporated in subsequent drafts of the Renewable Resource Development Report as the data becomes available.

A high-level assessment of renewable energy potential in the WECC published in July 2002 by the Land and Water Fund of the Rockies was used as the primary data source for technical potential for the Western Electricity Coordinating Council (WECC) region: *Renewable Energy Atlas of the West: A Guide to the Region's Resource Potential*. California specific data comes, in part, from the Regional Economic Research, *Technical Potential of Renewable Resource Technologies*, published in June 2002, which was used as a standard against which other data for California were measured.

Except where noted, figures are estimates of remaining potential after existing and proposed projects have been subtracted from the total technical potential. The data for existing and proposed projects exclude renewable technologies that are not appropriate for large-scale electricity generation or that have unproven technical issues, including hot dry rock and magma (geothermal). Although WECC solar energy projects were excluded from discussion of proposed renewable energy, solar energy (i.e., solar thermal electric and some photovoltaic systems) is included in the estimation of the 2001 baselines. Discussion of the technical potential for solar energy projects is limited. The principal focus in that discussion is on solar thermal electric potential, but solar photovoltaic potential has also been included when it has been grouped with solar thermal potential.

Renewable energy resource technical potential data are approximations of the total amount of energy that could be generated from each resource type. Theoretically, the renewable resources considered in this section have the potential to supply many times over the WECC region's entire electricity needs. However, technical potential measures only the generation potential based on resource availability and ignores obstacles associated with getting that generation to market. In addition, technology improvements could significantly alter the potential figures.

In addition to the Energy Atlas and the RER report, data regarding technical potential for renewable energy in California and other WECC states was obtained from a number of other publicly available sources.[8] In some cases the data has been converted from MW to GWh/year for ease of comparison. Capacity factors used for technical potential are geothermal at 90%, biomass at 80%; wind at 35% and solar thermal at 15%. The capacity factor for proposed and potential solar thermal differs from the factor used for existing solar thermal (27%), because it assumes that future solar thermal electric systems will not use natural gas to power part of their electricity generation. The WECC figures shown in this section include data for California.

Estimates for California's renewable technical potential vary, sometimes greatly, among studies. The reasons for these variations may include the different time frames in which the studies were conducted, the filtering of data using differing criteria, and in the case of solar, how photovoltaic and central station are counted or characterized. Solar energy is included in the potential as future innovations in the technology may increase its utilization for utility-scale applications.[9] Using a 2002 study by Regional Economic Research, *Technical Potential of Renewable Resource Technologies*, as a base comparison, Figure 10 displays the range of renewable energy potential for wind, geothermal, biomass, and solar in California. This figure does not exclude existing or proposed renewable energy facilities. Error bars show the range of technical potential estimates across studies. For example, the lowest estimate of technical potential for California geothermal in the studies reviewed for this assessment was 28,200 GWh/year. The highest estimate for geothermal in California was 104,300 GWh/year. This figure suggests that California's RPS goal could be met by resources based in California if necessary, without exhausting the technical potential.

[8] Data on technical potential was drawn from the following sources: (1) Technology Potential of Renewable Resource Technologies, RER, June 2002; (2) Renewable Energy Atlas of the West, Land and Water Fund of the Rockies; (3) Generating Solutions, Environment California, 2003; (4) Renewable Energy for California, Renewable Energy Policy Project, March 2002; (5) Fuel from the Sky, NREL, July 2002; (6) Assessment of the Available Windy Land Area and Wind Energy Potential in the U.S., PNL, 1991.

[9] For cost information regarding solar thermal electric and other central station electricity generation technologies, see Energy Commission, June 6, 2003, *Comparative Cost of California Central Station Electricity Generation Technologies*, (100-03-001F). Available online at http://www.energy.ca.gov/energypolicy/documents/index.html. Accessed June 30, 2003.

Figure 10. Range of Technical Potential in California, by Technology (GWh/year)

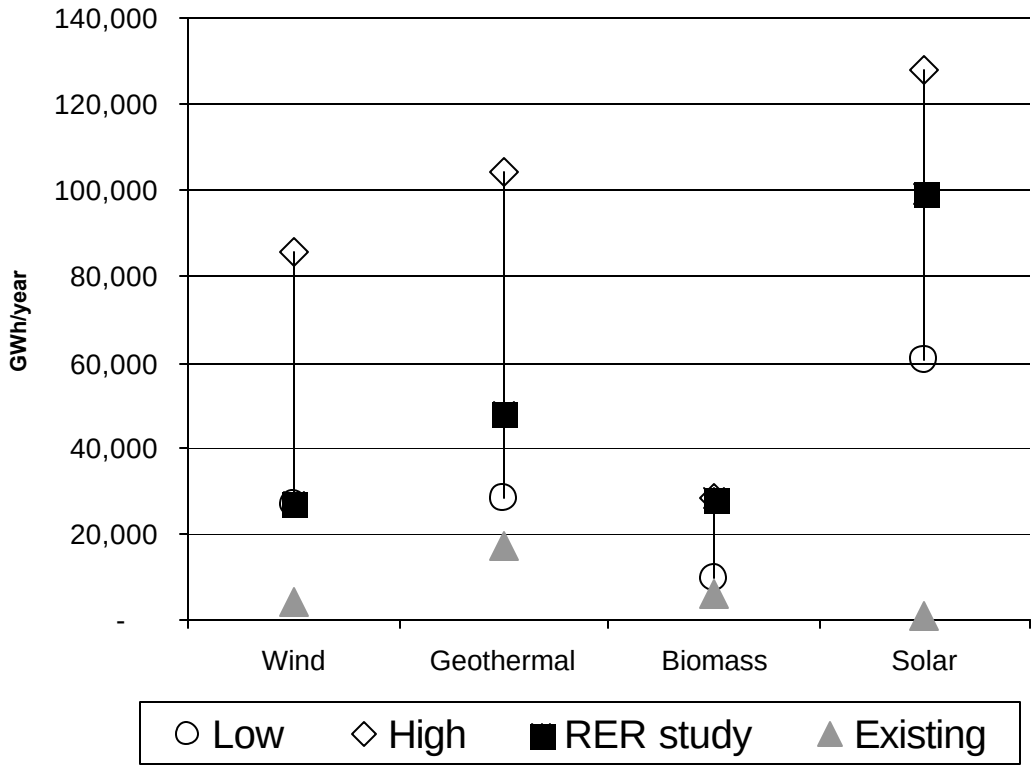
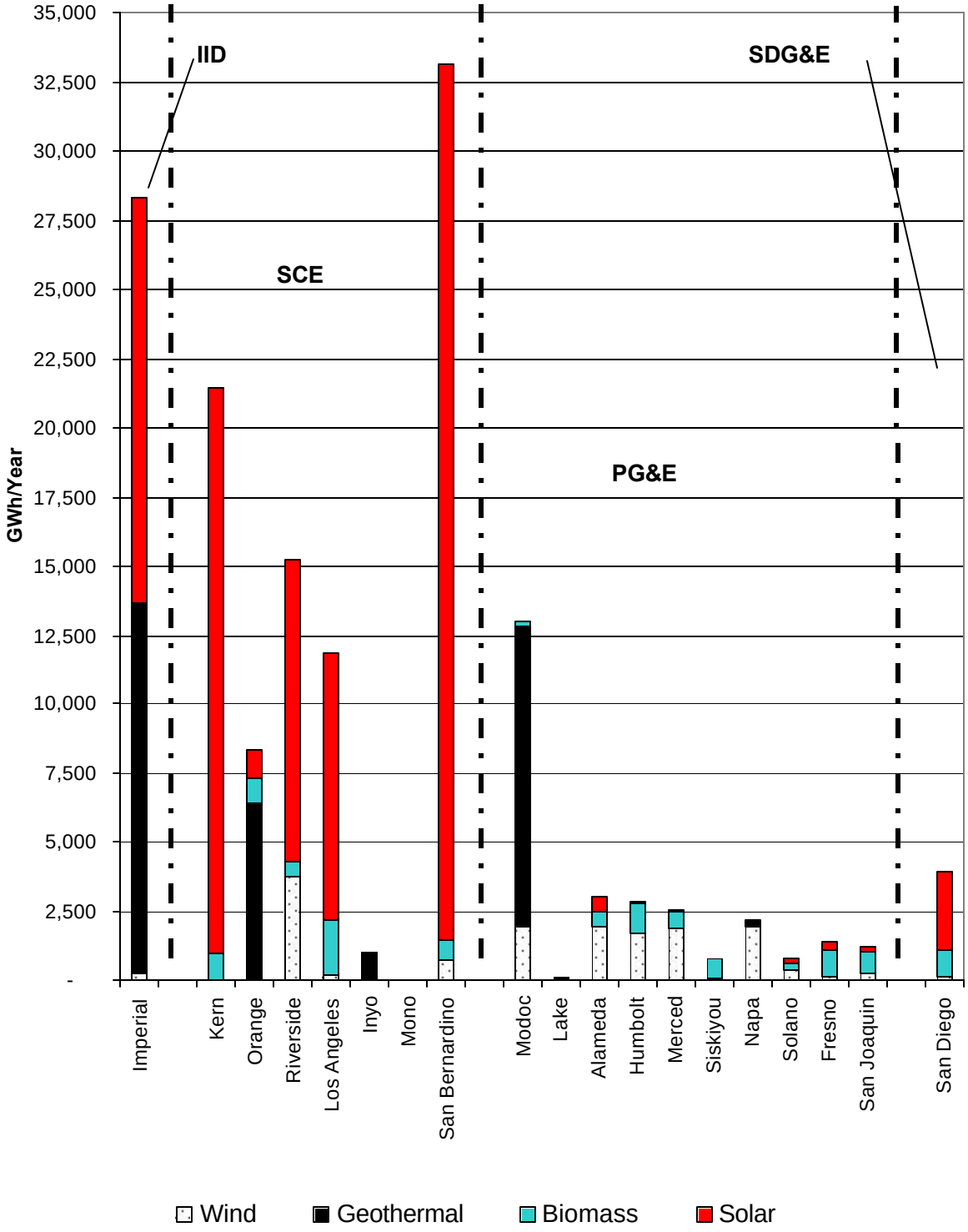


Figure 11 shows an estimation of the remaining renewable energy potential for wind, geothermal, and biomass in California by county. The "remaining" potential energy was calculated by subtracting existing renewable energy facilities and any proposed from the total technical potential. This method of calculation was used to separate the areas of renewable energy that are likely to be developed in 2005 and 2008 (i.e., proposed projects) from the renewable energy resources that may be developed by 2017 or thereafter (i.e., "remaining" potential). Where the data show that there is no remaining potential energy this means that the amount of existing plus the amount of proposed facilities is equal to (or greater than) the estimated technical potential for the county.

Figure 11. Remaining Renewable Energy Potential Wind, Geothermal, Biomass and Solar Thermal Electric in California's Top 19 Counties for Potential Renewable Energy



The technical potential of wind in Kern country falls below the sum of existing and proposed resources. This finding suggests either that the technical potential numbers are outdated or that the empirical data may have duplications in resource development that were not identified. Regarding the former possibility, a recent study conducted by researchers at Stanford University suggests that modern wind turbines can harness wind resources available at higher heights than the heights at which wind speeds have been measured in publicly available estimates of technical potential. The technical potential of Kern County identified in the RER report was 1,152 MW. The proposed renewable energy facilities identified in data reviewed for this report total 2,500 MW. Subsequent to preparation of the data for this report, Staff learned of SCE's solicitation for renewable resources yielded proposals in Kern County totaling 3,790 MW.[10] Clarification of this contradiction is part of ongoing work to be summarized in the RRDR before the end of the year.

Appendix B contains maps regarding Energy Commission estimates of technical potential for geothermal, wind, and solar thermal electric in California by county. The renewable energy potential in Orange County is not expected to be developable, as it is located in heavily populated areas (i.e., Costa Mesa, Newport Beach, and Huntington Beach). Therefore, it is not shown in the geothermal map in Appendix B.

Remaining technical potential data for wind, biomass and geothermal in Figures 12 and 13 are from the *Renewable Energy Atlas of the West* for consistency of data across states. Figure 12 shows that the remaining technical potential for Washington, and adjacent WECC states totals roughly 200,000 GWh/year. Remaining technical potential for solar is shown together with existing and proposed development in Table 3 at the end of this section.

[10] See SCE's U 338-E filing dated May 1, 2003 (I.00-11-001). See also "Comments of Kern Wind Energy Association and Oak Creek Energy Systems, Inc" in Docket 02-IEP-1 for the June 24, 2003 Energy Commission Joint Committee Workshop.

Figure 12. Renewable Energy Potential in WA and adjacent WECC states (excluding existing and proposed facilities)

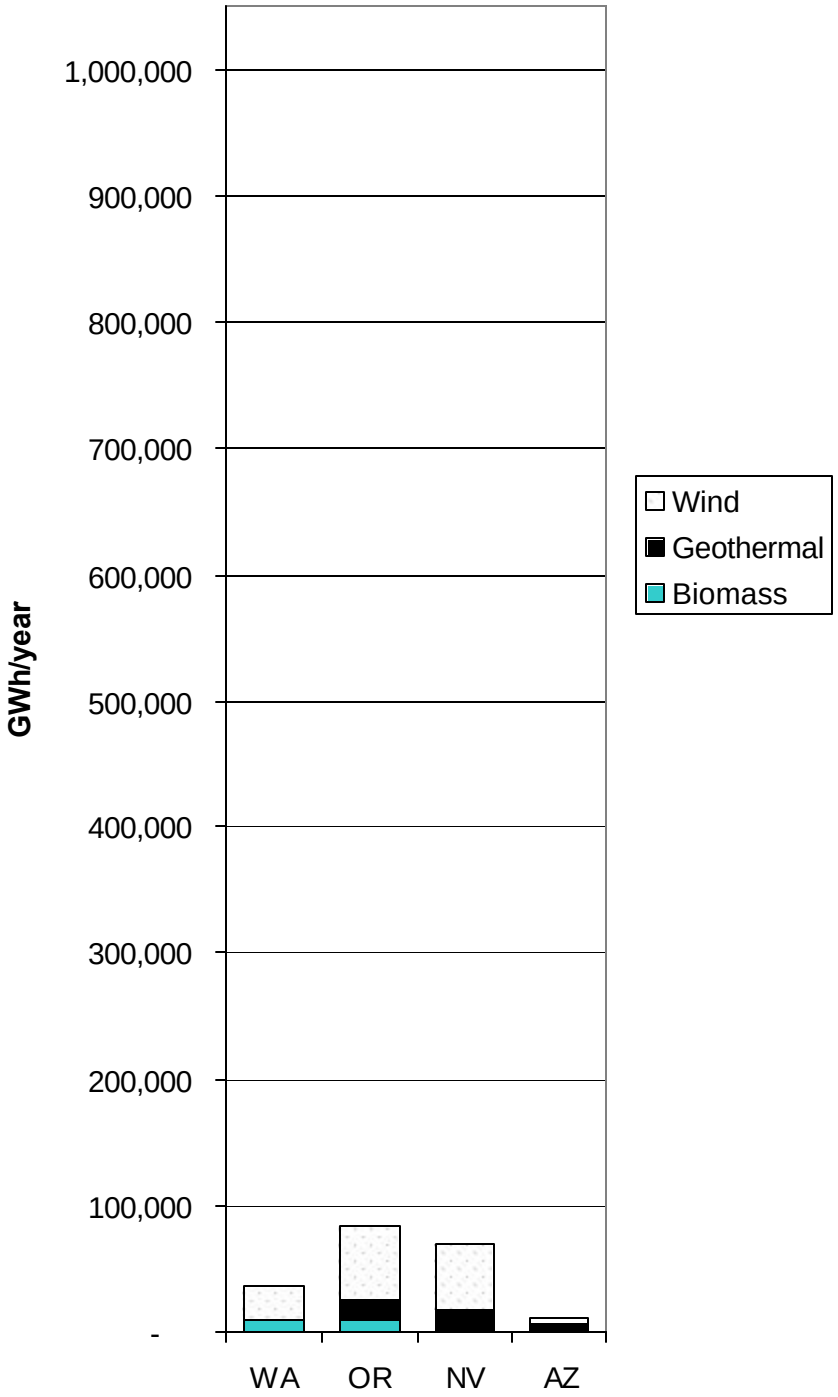


Figure 13. Renewable Energy Potential in WECC outer tier states (excluding existing and proposed)

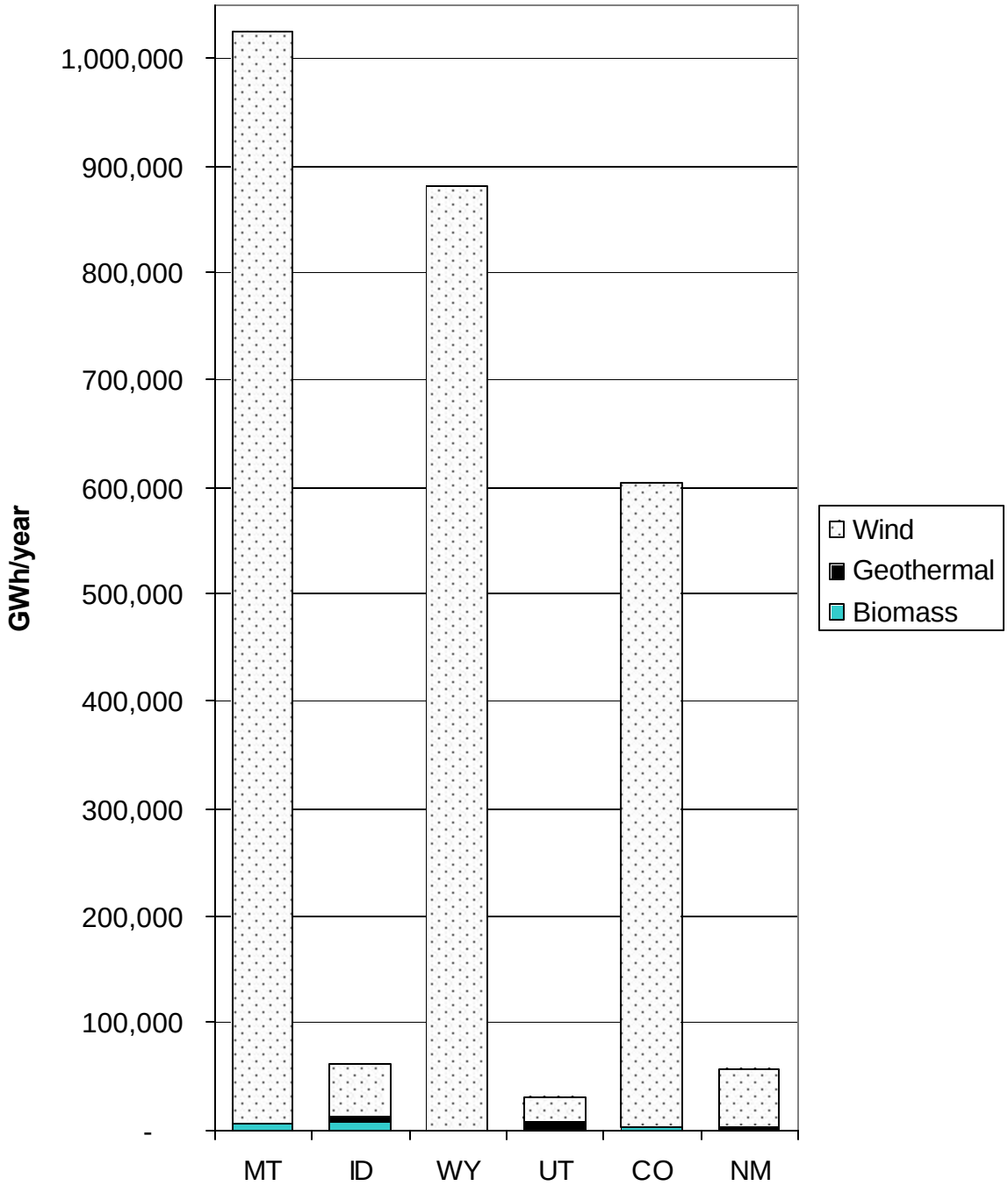


Figure 13 shows the technical potential for wind, geothermal, and biomass in the outer tier WECC states. The wind potential is so large (2.6 Million GWh/year) that it dwarfs the

potential for geothermal and biomass by comparison. The geothermal and biomass technical potential in the outer tier WECC states totals more than 35,500 GWh/year.

Technical potential for geothermal, wind, and biomass in the WECC as a whole, particularly when wind potential in "outer tier" states is considered, dwarfs California RPS demand. Montana, Wyoming and Colorado each have well over twice the highest estimated California renewable energy resource technical potential shown in Figure 10.

The following describes key points regarding technical potential in California and other WECC states:

Wind

- In California, wind potential (including existing and proposed facilities) ranks third after solar energy and geothermal, with estimates from 27,000 to 86,000 GWh/year (see Figure 10).
- For the WECC region as a whole, wind potential (including existing and proposed facilities) is about 3 million GWh/year.
- Nearly 2,300 MW of wind turbines are installed in the WECC region, according to the American Wind Energy Association.[11]
- Suitable wind areas are found on 6 percent of land in the WECC region.

Geothermal

- In California, geothermal potential (including existing and proposed facilities) ranks second to solar energy, with estimates ranging from 28,000 to 104,000 GWh/year.[12]
- For the WECC region as a whole, geothermal potential (including existing and proposed facilities) is estimated to be 118,000 GWh/year.
- Roughly 2,800 MW of geothermal capacity is installed capacity across the U.S.,[13] with most of that in the West.

Biomass

- In California, biomass potential ranks last after solar, geothermal and wind, with estimates ranging from 9,900 to 28,000 GWh/year.
- For the WECC region as a whole, biomass potential (including existing and proposed facilities) is estimated to be 57,500 GWh/year.
- Roughly 1,747 MW of biomass is currently installed in the WECC region.[14]

Solar (Thermal and Photovoltaic)

- In California, solar potential ranks first among renewable resources surveyed, with estimates ranging from 60,000 to 128,000 GWh/year.
- At least 394 MW of solar power (thermal and PV) is installed in California.

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[11] American Wind Energy Association, 2001, "Inventory of State Incentives for Wind Energy in the U.S."
[12] An assessment of the geothermal potential in the Mount Shasta/Weed area will be included in the RRDR.
[13] "Opportunities for Near Term Geothermal Development on Public Lands in the Western United States," U.S. DOE/EERE, April 2003.
[14] Land and Water Fund of the Rockies, Northwest Sustainable Energy for Economic Development, GreenInfo Network, July 2002, *Renewable Energy Atlas of the West: A Guide to the Region's Resource Potential*, a project of the Hewlett Foundation and the Energy Foundation. www.EnergyAtlas.org.

o For the WECC region as a whole, one estimate yielded 920,000 GWh/year.

Table 3. Existing, Proposed and Remaining Technical Potential for Solar Thermal Electric and Photovoltaic Generation Systems in the WECC (excluding California).

Inner tier	OR	0.07	-	68,000
	WA	0.37	-	42,000
	NV	0.11	66	92,934
	AZ	5.45	-	100,995
Sub-total Inner tier		**6**	**66**	**303,929**
Outer tier	UT	-	-	69,000
	NM	0.14	-	104,000
	ID	0.16	-	60,000
	CO	1.00	-	82,999
	MT	0.04	-	101,000
	WY	0.07	-	72,000
Sub-total Outer tier		**1**	**-**	**488,999**
WECC (excluding CA)	**Total**	**7**	**66**	**792,927**

The emphasis of the information provided in this assessment regarding technical potential is an identification of resources that are geographically concentrated (e.g., wind, geothermal, solar thermal electric).[15] Other renewable resources, such as biomass and solar photovoltaic systems tend to be located throughout the state and will need to be assessed on an individual basis, since they will most likely not create the need for major transmission upgrades themselves. Wind, geothermal, and solar thermal because of their geographic concentration in specific areas (e.g., Tehachapi, Siskiyou), may create the need for major transmission upgrades. This Preliminary Renewable Resource Assessment has been prepared to assist in the identification of renewable resources that may require major transmission upgrades in California.

[15] See Appendix B.

IV. Approach and Estimates of Plausible Scenarios to meet the RPS

This assessment focuses on estimating the amount of eligible renewable energy that will be needed by obligated entities to comply with the RPS program by 2005, 2008, and 2017. The assessment includes an estimate of the mix of technologies and geographic locations that could provide the needed renewable energy.

A. Assumptions and Approach

This preliminary assessment assumes that all RPS requirements will be met with renewable resources in California or near the border with the first point of connection to the Western Electricity Coordinating Council transmission system located within California. The SB 1038 Renewable Resources Development Report (RRDR) will contain a discussion of the potential role of out-of-state and international renewable energy resources in California's RPS. The RRDR will be a technical appendix to the Public Interest Energy Strategies (PIES) Assessment of the Integrated Energy Policy Report (IEPR) prepared pursuant to Senate Bill 1389 (SB 1389, Bowen, Chapter 568, Statutes of 2002).

The approach used to estimate the plausible scenario for development of renewable energy to respond to the RPS consisted of comparing the RPS demand with empirical data and technical potential data. Geographic areas with the greatest level of proposed projects are assumed to be those most likely to supply RPS demand.

For 2005 and 2008, we have made an assessment of regional location of renewable development based on information from previous solicitations, IOU requests that renewable generators indicate projects that will need interconnection to the transmission system, ISO-identified interests to interconnect to the transmission grid, and input from the Tehachapi proceeding.

The mix of technologies for the plausible scenario was developed based on the same assumptions as those for the assessment for regional location of renewable development. Previous solicitations and interconnection requests were used to develop a renewable energy mix of wind (60%), geothermal (25%), and biomass (15%) in California. Solar thermal represented less than 1%.

Where specific technologies are identified, the energy values (GWh/year) were converted to MW by using capacity factor assumptions of 35% for wind, 90% for geothermal, 80% for biomass and 15% for solar thermal electric.[16]

An important issue in planning for RPS compliance is the fact that although we can predict the amount of energy for entities to meet RPS goals, we cannot predict the exact resources

[16] The capacity factor for proposed and potential solar thermal differs from the factor used for existing solar thermal (27%), because it assumes that future solar thermal electric systems will not use natural gas to power part of their electricity generation.

that will provide this energy. For transmission planning there will need to be an assessment of the way that the electricity will move from the renewable energy generation source to the IOU or ESP/CCA, so that the renewable energy can be counted by the obligated entities toward their RPS requirements.

B. Pending RPS Decisions

In practice, the actual mix of technologies used to meet the RPS will be determined through bid solicitations and processes undertaken in accordance with the rules established by the CPUC and Energy Commission. For example, SB 1078 requires bids submitted in response to RPS solicitations to be selected according to a rank ordering of "least-cost and best-fit." The CPUC Order Initiating Implementation of the Senate Bill 1078 Renewable Portfolio Standard Program (June 19, 2003: 28) defines "best fit" as

> the renewable resources that best meet the utility's energy, capacity, ancillary service and local reliability needs," with the added condition that "for the short-term, renewable generation that can operate as dispatchable or peaker power may possibly fall slightly higher on the 'procurement hierarchy.'

The overall average operating profile of solar energy tracks summer peak hours in California more closely than other renewable energy resources.[17]

Another issue that will influence the technology mix used to meet the RPS is the methodology for calculating the market price referents. On June 19, the CPUC decided that the market price referent for baseload electricity will be a natural gas combined cycle plant and the referent for peaking energy will be a combustion turbine plant. The market price referent for as-available (intermittent) energy will be "either the baseload or peaking referent, depending on which product that resource bids" (p. 19). Although the methodology is known, the actual market price referent levels will not be known until after bids have been received.

Questions to be decided by the end of 2003 include determination of 1) whether and to what extent Renewable Energy Credits (RECs) will be utilized for RPS, 2) adoption of guidelines for allocation of Supplemental Energy Payments (SEPs), and 3) determination of rules for tracking and accounting for out-of-state participation.

These issues are beyond the scope of this assessment, which is focused on near-term supply and long-term technical potential of eligible in-state renewable energy resources.

In addition, the effect of distribute generation was not considered in this assessment since it was assumed distributed generation would be spread through out the transmission system and would have a smaller impact compared to centralized generating sources. An assessment of the distributed generation and RPS will be a part of the PIES/RRDR report.

[17] For information regarding peak energy demand in California, see California ISO, "Today's Outlook," updated every 10 minutes. Available online at http://www.caiso.com/outlook.html. Accessed June 17, 2003.

C. Plausible scenarios to meet SB 1078 Goals

The 2005 cumulative RPS demand beyond the resources identified by the 2003 Interim Procurement is estimated to be 2,540 GWh/year. In 2008, an additional 6,300 GWh/year beyond the amount required in 2005 must be added for a cumulative total of 8,840 GWh/year. By 2017, 12,360 GWh/year must be added to the cumulative figure for 2008 to reach a total additional procurement of 21,200 GWh/year. Tables 4 and 5 identify a plausible scenario for meeting RPS demand in 2005 and 2008 with renewable energy projects in California that have been proposed for construction or repowering.

The Kern County wind resource area, if developed in a concentrated manner, could satisfy much of the cumulative RPS demand through 2008. Based on the transmission proceeding dealing with Tehachapi transmission investments and the proposed SCE Long-Term Resource Plan, there is an indication of SCE's willingness to make these transmission investments.[18] This scenario identifies the Kern county wind resource area as a major contributor to RPS supply.

At the same time, the CPUC has given direction to utilities to plan diverse portfolios of resources.[19] We anticipate that the IOUs will seek geographic and resource diversity in their procurement plans. Geothermal and biomass resources can provide baseload power that matches the generation profile of some conventional resources.

For these reasons, the scenario includes geothermal resources as a factor in RPS supply to satisfy both 2005 and 2008 demand. Biomass, particularly landfill gas, is likely to play a role in RPS supply, but probably at smaller project scales and in areas that are closer to load (therefore not requiring new transmission investment). This scenario also includes wind projects proposed in other resource areas. The scenario shown in Tables 4 and 5 presumes that Kern county wind begins to be developed by 2005 with a deeper penetration by 2008.

The scenario presumes that southern California geothermal resources make it to market more quickly than northern California geothermal resources, but northern California resources do make it online by 2008. This scenario presumes that biomass is a relatively small contributor in 2005 and 2008 RPS compliance efforts. Due to differences in timing, the technology mix for each of the years highlighted in the table varies somewhat from the total proposed renewable additional energy.

Table 4 shows a plausible scenario for the physical location of additional renewable energy facilities utilized to meet California's RPS in 2005, 2008, and 2017. The additional RPS demand for 2005, 2008, and 2017 is listed at the top of each of this table to show the amount that additional supply should reach. Proposed projects were allocated so that the total additional supply for each year shown at the bottom of the table would match the estimated RPS demand. Information for each project is shown in the rows of the table. The total proposed GWh/year for each project is shown in the "Proposed" column, and broken out by

[18] See CPUC R.01-10-024, SCE-L-1, U 338-E filed on April 15, 2003.
[19] See CPUC D.02.10-062 (October 25, 2002).

year according to the process described below. The remaining potential column shows an estimate of technical renewable energy potential GWh/year in California excluding existing facilities and proposed projects. The county and resource are listed for each project and the projects are sorted by the IOU service territory in which they are geographically located.

Table 4. California RPS Supply Scenario by Physical Location - in GWh/year (Resources Located in California)

Gwh		Additional Supply to meet RPS demand					
		Proposed	2005	2008	2017	Total	Remaining Potential
Physical location (IOU)/IID	**Additional RPS Demand**		2,540	6,300	12,360	21,200	
	County/Resource						
PG&E	Siskiyou/geothermal	1,480		800	680	1,480	6,280
	Solano/wind	1,230	400	200	630	1,230	380
	Modoc/geothermal	830			830	830	3,130
	Alameda/wind	640		200	440	640	1,930
	Other wind	0				0	8,970
	Other geothermal	0				0	930
	Other biomass	525	125	55	345	525	13,380
	Other solar						6,020
(IID)	Imperial/geothermal	1,890	800	580	510	1,890	13,450
	Imperial/biomass	560			560	560	0
	Imperial/wind	0				0	230
	Imperial/solar						14,600
SCE	Kern/wind	11,620	1,000	2,760	5,200	8,960	0[a]
	Mono/geothermal	2,760			1,222	1,222	0[a]
	Riverside/wind	1,085	140	245	700	1,085	3,760
	San Bernardino/wind	160			160	160	740
	San Bernardino/ solar thermal	158			158	158	31,710[b]
	Los Angeles/biomass	550		550		550	2,020
	Los Angeles/wind	310		310		310	160
	Other wind	90			90	90	360
	Other geothermal	0				0	7,440
	Other biomass	210			210	210	4,270
	Other solar						42,760
SDG&E	San Diego/wind	1,225		600	625	1,225	150
	San Diego/biomass	75	75			75	950
	San Diego/solar						2,800
	Total Resources	**25,400**[c]	**2,540**	**6,300**	**12,360**	**21,200**	**166,420**[d]

[a] Existing and proposed wind energy development in Kern County exceeds the RER estimate of total potential used for this report. Clarification of this contradiction is part of ongoing work to be summarized in the Renewable Resources Development Report before the end of 2003.

[b] Includes photovoltaics.

[c] The total proposed shown here (25,400 GWh/year) excludes 1,452 GWh/year of proposed renewable energy identified as "North of Path 15" or "South of Path 15."

[d] Excludes SMUD remaining potential: 10 GWh wind, 630 GWh geothermal, and 450 GWh solar.

Table 5 converts the information in Table 4 to MW using the following capacity factors: wind (35%), geothermal (90%), biomass (80%) and solar (15%).

Table 5. California RPS Supply Scenario by Physical Location - in MW (Resources Located in California)

Physical location (IOU)/IID	County/Resource	Capacity Factor	Proposed	2005	2008	2017	Total	Remaining Potential
PG&E	Siskiyou/geothermal	90%	185		100	85	185	805
	Solano/wind	35%	400	130	65	205	400	125
	Modoc/geothermal	90%	105			105	105	400
	Alameda/wind	35%	210		65	145	210	630
	Other wind	35%						2,925
	Other geothermal	90%						120
	Other biomass	80%	75	20	5	50	75	1,910
	Other solar	15%						4,580
(IID)	Imperial/geothermal	90%	240	100	75	65	240	1,710
	Imperial/biomass	80%	80			80	80	0
	Imperial/wind	35%						75
	Imperial/solar	15%						11,110
SCE	Kern/wind	35%	3,790	325	900	1,755	2,980	0
	Mono/geothermal	90%	350			155	155	0
	Riverside/wind	35%	355	45	80	230	355	1,225
	San Bernardino/wind	35%	50		50	0	50	240
	San Bernardino/solar	15%	120			120	120	24,500
	Los Angeles/biomass	80%	80		80	0	80	290
	Los Angeles/wind	35%	100		100	0	100	50
	Other wind	35%	30			30	30	120
	Other geothermal	90%						945
	Other biomass	80%	30			30	30	610
	Other solar	15%						32,540
SDG&E	San Diego/wind	35%	400		195	205	400	50
	San Diego/biomass	80%	10	10			10	135
	San Diego/solar	15%						2130
	Total Resources		**6,610**	**630**	**1,715**	**3,255**	**5,605**	**87,225**

V. Conclusions

This study compares the CEC's estimated need for additional renewable energy resources with potential supply to meet the RPS requirements of the obligated investor owned utilities (IOUs) and any other "obligated entities" (electric service providers and community choice aggregators: ESP/CCA). The IOUs included in this analysis are Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E).

Staff estimates that IOUs and ESP/CCAs will have to maintain their 2001 baselines, achieve and maintain their Interim Procurements, and add an estimated 21,200 GWh/year of renewable energy to their supply portfolio by 2017 to meet the RPS mandate. In the more

near term, 2,540 GWh/year will need to be added by 2005 and 8,843 GWh/year will need to be added by 2008.

Staff estimates that by 2005, PG&E will need to add 1,253 GWh/year of renewable energy SCE will need to add 756 GWh/year, and SDG&E will need to add 0 GWh/year. 2005 RPS requirements for ESP/CCAs geographically located in each of these areas are estimated to be 188 GWh/year (PG&E), 259 GWh/year (SCE), and 84 GWh/year (SDG&E).

By 2008, staff estimates required cumulative additions of renewable energy to be 4,169 GWh/year for PG&E, 2,965 GWh/year for SCE, and 319 GWh/year for SDG&E. 2008 cumulative additions in ESP/CCAs geographically located in each of these IOU service areas are estimated to be 489 GWh/year (PG&E), 677 GWh/year (SCE), and 223 GWh/year (SDG&E).

By 2017, staff estimates required cumulative additions of renewable energy to be 9,521 GWh/year for PG&E, 5,123 GWh/year for SCE, and 2,721 GWh/year for SDG&E. 2017 cumulative additions in ESP/CCA's geographically located in each of the IOU service areas are estimated to be 1,314 GWh/year (PG&E), 1,873 GWh/year (SCE), and 650 GWh/year (SDG&E).

These goals are ambitious but achievable, as they represent increasing existing renewable resource supply by more than 70%. However, meeting these requirements would not come close to exhausting the estimated technical potential of renewable energy in the WECC, which has an estimated technical potential on the order of 4 million GWh/year. Looking at California in isolation from WECC, technical potential for remaining undeveloped (i.e., excluding existing and proposed facilities) wind (16,670 GWh/year), geothermal (31,230 GWh/year), biomass (21,250 GWh/year) and solar (98,360 GWh/year) energy is estimated to total more than 167,500 GWh/year.

Staff estimates California's RPS requirements to be quite close in magnitude to proposed projects for new and repowered renewable energy facilities in California. Additional wind, geothermal, biomass, and solar facilities that could generate more than 28,600 GWh/year have been proposed in various solicitations in California that have been collected by the Energy Commission (projects from additional solicitations that have not been made available to the Energy Commission would add to this figure, perhaps significantly), with about 60% wind, 25% geothermal, and 15% biomass.

Using this information, Staff used a split factor of 60% wind, 25% geothermal, and 15% biomass to build a plausible scenario of the average proportion of renewable resources that each obligated entity could use to meet their RPS obligations. For example, this calculation suggests that PG&E could meet its 2005 RPS requirement by constructing or purchasing 752 GWh/year of wind, 313 GWh/year of geothermal and 188 GWh/year of biomass.

It is quite possible that the geographic location of some of the facilities that produce energy utilized by PG&E to meet its RPS requirements will be located in SCE or SDG&E service territories or vice versa. The plausible scenario shows physical location of renewable energy

facilities used to meet the RPS in 2005 and 2008. It does not show the IOUs that will be served by these facilities.

This scenario assumes that all renewable energy facilities utilized to meet California's RPS are located in California. At the time of this report, many of the rules regarding out-of-state participation in California's RPS were still under development. The mechanisms and expected magnitude for out-of-state participation will be known with greater certainty later this year. Accordingly, the Renewable Resources Development Report to be completed later this year will include a plausible scenario for the role of renewable resources located outside of California.

We conclude that renewable energy resource supply is not likely to constrain IOUs and ESP/CCAs from meeting their RPS obligation. This study offers a review of the empirical project data, the technical potential data to support the plausible scenario that we offer to support meeting the 2005 and 2008 RPS obligation of the IOUs and ESP/CCAs.

This assessment focused on an estimation of the amount of qualifying renewable energy that will be needed by obligated entities for 2005, 2008, and 2017 to comply with the RPS program. In the end, it will be the market that will determine the actual mix of renewable resources. The development of renewable energy to meet the RPS will be influenced by a number of issues that are being debated now, with regulatory decision yet to be made on how they will be implemented. Some of these issues include Renewable Energy Credits (RECs), allocation of Supplemental Energy Payments (SEP), and rules regarding tracking, and accounting of out-of-state renewable energy. These issues are beyond the scope of this assessment, which is focused on near term supply and long term potential of qualifying in-state renewable resources.

Appendices

Appendix A. Estimation of Energy Requirements to meet California's RPS by 2017

Appendix B. County Maps of California Technical Potential for Wind, Geothermal and Solar Energy

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Appendix A. Estimation of Energy Requirements to meet California's RPS by 2017

		Staff's Outlook for California - Retails Sales by Utility (GWh). Lynn Marshall. Energy Commission's Demand Analysis office through 2013. Staff projected out to 2017 based on (1a)													2014-2017 sales figures assumed at "Annual Growth Rate" of 2003-2013			
			2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**
1	**Sales (GWh)**	**PG&E**	75,681	69,950	70,706	72,496	74,205	75,748	76,879	78,530	79,535	80,751	81,814	82,812	83,569	84,989	86,434	87,904	89,398
		SCE	74,286	65,450	66,225	68,146	70,266	72,054	73,126	74,365	75,272	76,234	77,383	78,550	79,289	80,717	82,169	83,649	85,154
		SDG&E	15,000	14,394	14,592	14,947	15,304	15,666	15,938	16,348	16,604	16,826	17,068	17,363	17,541	17,875	18,214	18,560	18,913
		Total	164,967	149,793	151,523	155,589	159,776	163,468	165,943	169,243	171,410	173,811	176,265	178,725	180,399	183,581	186,818	190,112	193,465
		Grand Total Statewide Sales	242,861	241,668	244,139	249,809	255,549	260,671	264,276	268,895	272,165	275,829	279,551	283,252	286,139	290,717	295,368	300,094	304,896
		DA and Rest of State	77,894	91,875	92,616	94,220	95,773	97,203	98,333	99,652	100,755	102,018	103,286	104,526	105,739	107,136	108,550	109,982	111,431
		PG&E DA	3,761	8,321	8,320	8,427	8,537	8,647	8,760	8,873	8,989	9,106	9,225	9,345	9,468	9,591	9,715	9,842	9,970
		SCE DA	4,168	11,088	11,087	11,267	11,451	11,638	11,828	12,021	12,218	12,417	12,621	12,827	13,038	13,246	13,458	13,673	13,892
		SDG&E	2,463	3,423	3,423	3,498	3,575	3,654	3,735	3,818	3,902	3,989	4,078	4,168	4,261	4,355	4,451	4,549	4,649
		Total DA	10,392	22,832	22,830	23,193	23,563	23,939	24,322	24,712	25,109	25,512	25,923	26,341	26,767	27,192	27,624	28,064	28,511
		Total Rest of State	67,502	69,043	69,787	71,027	72,210	73,264	74,011	74,940	75,646	76,506	77,363	78,185	78,973	79,944	80,926	81,918	82,920
		DA % of non IOU	13.34%	24.85%	24.65%	24.62%	24.60%	24.63%	24.73%	24.80%	24.92%	25.01%	25.10%	25.20%	25.31%	25.38%	25.45%	25.52%	25.59%
		Rest of State % of nc	86.66%	75.15%	75.35%	75.38%	75.40%	75.37%	75.27%	75.20%	75.08%	74.99%	74.90%	74.80%	74.69%	74.62%	74.55%	74.48%	74.41%
		Percent IOU sales	67.93%	61.98%	62.06%	62.28%	62.52%	62.71%	62.79%	62.94%	62.98%	63.01%	63.05%	63.10%	63.05%	63.15%	63.25%	63.35%	63.45%
		Percent DA	4.28%	9.45%	9.35%	9.28%	9.22%	9.18%	9.20%	9.19%	9.23%	9.25%	9.27%	9.30%	9.35%	9.35%	9.35%	9.35%	9.35%
		Percent Rest	27.79%	28.57%	28.58%	28.43%	28.26%	28.11%	28.01%	27.87%	27.79%	27.74%	27.67%	27.60%	27.60%	27.50%	27.40%	27.30%	27.20%
2	**2001 Base-line**	THIS IS CHANGEABLE	GWh	%															
		PG&E	7,532	9.95%		This is for a 14 year total (accounts for 2003 Interim Procurement)													
		SCE	11,160	15.02%		**20% Goal**	**Minus Baseline**	**Avg. GWh Yr**	**MW/Year**	**MW/Year**									
		SDG&E	112	0.74%		Take 20%	Base and 2003	Divide by 14	**50 % CF**	**55 % CP**									
		Total	18,804	11.40%		5,702.14	5,702.14	407.30	**93**	**85**	**DA no baseline**								
						5,702.14	3,836.97	274.07	**63**	**57**	**DA w/ baseline**								
	7.17%	**PG&E DA**	270	7.17%															
		SCE DA	299	7.17%		16,583.98	9,406.99	671.93	153	139	**Rest of State**								
		SDG&E	177	7.17%		38,693.02	17,770.19	1,269.30	290	263	IOU								
		Total DA	745	7.17%															
		Total DA and IOU Ba	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549	19,549
		Total Rest of State	6,267	9.28%		This is for a 15 year total (baseline only)													
						20% Goal	**Minus Baseline**	**Avg. GWh Yr**	**MW/Year**	**MW/Year**									
		J-11 Figure	25,816			Take 20%	Base only	Divide by 15	**50 % CF**	**55 % CP**									
						5,702.14	5,702.14	380.14	**87**	**79**	**DA no baseline**								
						5,702.14	4,957.04	330.47	**75**	**69**	**DA w/ baseline**								
						16,583.98	10,316.95	687.80	157	143	**Rest of State**								
						38,693.02	19,889.29	1,325.95	303	275	IOU								
3	**1% Minimum Percentage Point Growth (capped) as**	[% shown in (Section 2)] + [1%] up to [20%].																	
		PG&E			10.95%	11.95%	12.95%	13.95%	14.95%	15.95%	16.95%	17.95%	18.95%	19.95%	20.00%	20.00%	20.00%	20.00%	20.00%
		SCE			16.02%	17.02%	18.02%	19.02%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
		SDG&E			1.74%	2.74%	3.74%	4.74%	5.74%	6.74%	7.74%	8.74%	9.74%	10.74%	11.74%	12.74%	13.74%	14.74%	15.74%
		Total			12.28%	13.29%	14.30%	15.30%	16.29%	16.84%	17.40%	17.96%	18.52%	19.08%	19.20%	19.29%	19.39%	19.49%	19.58%
		PG&E DA			8.17%	9.17%	10.17%	11.17%	12.17%	13.17%	14.17%	15.17%	16.17%	17.17%	18.17%	19.17%	20.00%	20.00%	20.00%
		SCE DA			8.17%	9.17%	10.17%	11.17%	12.17%	13.17%	14.17%	15.17%	16.17%	17.17%	18.17%	19.17%	20.00%	20.00%	20.00%
		SDG&E			8.17%	9.17%	10.17%	11.17%	12.17%	13.17%	14.17%	15.17%	16.17%	17.17%	18.17%	19.17%	20.00%	20.00%	20.00%
		Total DA			8.17%	9.17%	10.17%	11.17%	12.17%	13.17%	14.17%	15.17%	16.17%	17.17%	18.17%	19.17%	20.00%	20.00%	20.00%
		Total Rest of State			10.28%	11.28%	12.28%	13.28%	14.28%	15.28%	16.28%	17.28%	18.28%	19.28%	20.00%	20.00%	20.00%	20.00%	20.00%

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Gray shading is explanatory.
Green shading is from CPUC filings or press releases regarding future procurements.
Purple shading is from CPUC fillings or press releases regarding the 2001 Baseline.

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Appendix A. Estimation of Energy Requirements to meet California's RPS by 2017

			2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
4	1% Minimum Percentage Point Growth (capped) as		(Section 3) * (Section 1).																
		PG&E			7,744	8,665	9,611	10,569	11,495	12,527	13,483	14,497	15,506	16,523	16,714	16,998	17,287	17,581	17,880
		SCE			10,611	11,601	12,664	13,707	14,625	14,873	15,054	15,247	15,477	15,710	15,858	16,143	16,434	16,730	17,031
		SDG&E			255	410	573	743	916	1,103	1,286	1,471	1,663	1,866	2,060	2,278	2,503	2,737	2,978
		Total			18,610	20,676	22,848	25,019	27,036	28,503	29,823	31,215	32,645	34,099	34,632	35,419	36,224	37,047	37,888
		PG&E DA			680	773	868	966	1,066	1,169	1,274	1,381	1,492	1,605	1,720	1,839	1,943	1,968	1,994
		SCE DA			906	1,033	1,165	1,300	1,439	1,583	1,731	1,884	2,041	2,202	2,369	2,539	2,692	2,735	2,778
		SDG&E			280	321	364	408	455	503	553	605	659	716	774	835	890	910	930
		Total DA			1,865	2,127	2,396	2,674	2,960	3,255	3,558	3,870	4,192	4,523	4,863	5,213	5,525	5,613	5,702
		Total Rest of State			7,177	8,015	8,870	9,733	10,572	11,454	12,318	13,223	14,145	15,077	15,795	15,989	16,185	16,384	16,584
5	Additional Energy (GWh) Per Year on top of Baseline		For 2003, (Section 4) - (Section 2). For other years, (Section 4 current year) - (Section 4 prior year)																
		PG&E			212	921	946	957	927	1,032	956	1,014	1,009	1,017	191	284	289	294	299
		SCE			-	989	1,063	1,043	918	248	181	192	230	233	148	285	291	296	301
		SDG&E			143	156	163	170	172	187	183	185	192	202	195	218	225	233	241
		Total			355	2,066	2,173	2,170	2,017	1,467	1,320	1,392	1,431	1,453	533	787	805	823	841
		PG&E DA			410	93	95	98	100	103	105	108	110	113	116	118	105	25	26
		SCE DA			607	127	131	135	140	144	148	152	157	162	166	170	152	43	44
		SDG&E			103	41	43	45	46	48	50	52	54	56	59	61	55	20	20
		Total DA			1,120	262	270	278	286	295	303	312	322	331	341	349	312	88	89
		Total Rest of State			910	838	856	862	839	882	864	905	922	932	717	194	196	198	200
6	Needed or Known Growth - percent (total) - if NOT at 20% by 2017 with simple 1 % growth		Green highlights represent known Procurements. Otherwise, if not at 20% by (Section 3) method, grow at annual average percent to reach 20% by 2017. If percentage drops over time, this is because the IOU procured more in one year than they were required to, so they are "banking" it forward. The percentage will increase once procurements start again.																
		PG&E			11.82%	11.95%	12.95%	13.95%	14.95%	15.95%	16.95%	17.95%	18.95%	19.95%	20.00%	20.00%	20.00%	20.00%	20.00%
		SCE			17.98%	17.47%	18.02%	19.02%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%
		SDG&E			4.50%	7.10%	6.94%	6.78%	7.16%	8.45%	9.73%	11.01%	12.30%	13.58%	14.87%	16.15%	17.43%	18.72%	20.00%
		Total			13.81%	13.91%	14.61%	15.50%	16.43%	17.01%	17.59%	18.18%	18.77%	19.35%	19.50%	19.63%	19.75%	19.87%	20.00%
		PG&E DA			8.17%	9.17%	10.17%	11.17%	12.17%	13.17%	14.17%	15.17%	16.17%	17.17%	18.17%	19.17%	20.00%	20.00%	20.00%
		SCE DA			8.17%	9.17%	10.17%	11.17%	12.17%	13.17%	14.17%	15.17%	16.17%	17.17%	18.17%	19.17%	20.00%	20.00%	20.00%
		SDG&E			8.17%	9.17%	10.17%	11.17%	12.17%	13.17%	14.17%	15.17%	16.17%	17.17%	18.17%	19.17%	20.00%	20.00%	20.00%
		Total DA			8.17%	9.17%	10.17%	11.17%	12.17%	13.17%	14.17%	15.17%	16.17%	17.17%	18.17%	19.17%	20.00%	20.00%	20.00%
		Total Rest of State			10.28%	11.28%	12.28%	13.28%	14.28%	15.28%	16.28%	17.28%	18.28%	19.28%	20.00%	20.00%	20.00%	20.00%	20.00%
7	Needed or Known Growth - GWh (total) - if NOT at 20% by 2017 with simple 1 %		(Section 6) * (Section 1).																
		PG&E			8,358	8,665	9,611	10,569	11,495	12,527	13,483	14,497	15,506	16,523	16,714	16,998	17,287	17,581	17,880
		SCE			11,908	11,908	12,664	13,707	14,625	14,873	15,054	15,247	15,477	15,710	15,858	16,143	16,434	16,730	17,031
		SDG&E			657	1,062	1,062	1,062	1,142	1,381	1,616	1,853	2,099	2,358	2,608	2,887	3,175	3,474	3,783
		Total			20,923	21,635	23,337	25,337	27,262	28,781	30,153	31,597	33,081	34,591	35,179	36,028	36,896	37,784	38,693
		PG&E DA			680	773	868	966	1,066	1,169	1,274	1,381	1,492	1,605	1,720	1,839	1,943	1,968	1,994
		SCE DA			906	1,033	1,165	1,300	1,439	1,583	1,731	1,884	2,041	2,202	2,369	2,539	2,692	2,735	2,778
		SDG&E			280	321	364	408	455	503	553	605	659	716	774	835	890	910	930
		Total DA			1,865	2,127	2,396	2,674	2,960	3,255	3,558	3,870	4,192	4,523	4,863	5,213	5,525	5,613	5,702
		Total DA and IOU	19549	19549	22,788	23,762	25,733	28,011	30,222	32,036	33,711	35,467	37,273	39,114	40,043	41,240	42,421	43,397	44,395
		Total Rest of State			7,177	8,015	8,870	9,733	10,572	11,454	12,318	13,223	14,145	15,077	15,795	15,989	16,185	16,384	16,584

Appendix A. Estimation of Energy Requirements to meet California's RPS by 2017

			2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
8	**Additional Energy (GWh) Per Year on top**		For 2003, (Section 7) - (Section 2). For other years, (Section 7 current year) - (Section 7 prior year)																
		PG&E			826	307	946	957	927	1,032	956	1,014	1,009	1,017	191	284	289	294	299
		SCE			748	-	756	1,043	918	248	181	192	230	233	148	285	291	296	301
		SDG&E			545	405	-	-	80	239	235	238	246	259	249	279	289	299	309
		Total			2,119	712	1,702	2,000	1,925	1,519	1,372	1,444	1,484	1,510	588	849	868	888	909
		MW/Year with 50% CF			484	163	389	457	439	347	313	330	339	345	134	194	198	203	207
		PG&E DA			410	93	95	98	100	103	105	108	110	113	116	118	105	25	26
		SCE DA			607	127	131	135	140	144	148	152	157	162	166	170	152	43	44
		SDG&E			103	41	43	45	46	48	50	52	54	56	59	61	55	20	20
		Total DA			1,120	262	270	278	286	295	303	312	322	331	341	349	312	88	89
		MW/Year with 50% CF			256	60	62	63	65	67	69	71	73	76	78	80	71	20	20
		Total Rest of State			910	838	856	862	839	882	864	905	922	932	717	194	196	198	200
		MW/Year with 50% CF			208	191	195	197	192	201	197	207	210	213	164	44	45	45	46
9	**Cumulative Energy (GWh) Per Year on**		For 2003, (Section 8). For other years, (Section 8 current year) + (Section 9 prior year)																
		PG&E			826	1,133	2,079	3,037	3,963	4,995	5,951	6,965	7,974	8,991	9,182	9,466	9,755	10,049	10,347
		SCE			748	748	1,504	2,547	3,465	3,713	3,894	4,087	4,317	4,550	4,698	4,983	5,274	5,570	5,871
		SDG&E			545	950	950	950	1,030	1,269	1,504	1,742	1,987	2,247	2,496	2,775	3,064	3,362	3,671
		Total			2,119	2,831	4,533	6,533	8,458	9,978	11,349	12,793	14,278	15,787	16,375	17,224	18,092	18,980	19,889
		Cumulative MW with 50% CF			484	646	1,035	1,492	1,931	2,278	2,591	2,921	3,260	3,604	3,739	3,932	4,131	4,333	4,541
		PG&E DA			410	503	599	696	796	899	1,004	1,112	1,222	1,335	1,451	1,569	1,673	1,699	1,724
		SCE DA			607	734	866	1,001	1,141	1,284	1,432	1,585	1,742	1,904	2,070	2,240	2,393	2,436	2,480
		SDG&E			103	144	187	232	278	326	376	429	483	539	598	658	714	733	753
		Total DA			1,120	1,382	1,651	1,929	2,215	2,509	2,813	3,125	3,447	3,778	4,118	4,468	4,780	4,868	4,957
		Cumulative MW with 50% CF			256	315	377	440	506	573	642	713	787	862	940	1,020	1,091	1,111	1,132
		Total Rest of State			910	1,748	2,603	3,466	4,305	5,187	6,051	6,956	7,878	8,810	9,528	9,722	9,918	10,117	10,317
		Cumulative MW with 50% CF			208	399	594	791	983	1,184	1,382	1,588	1,799	2,011	2,175	2,220	2,264	2,310	2,355
10	**top of Baseline AFTER 2003 and 2004 KNOWN PROCUREMENTS**		For 2003, zero. For 2004, (Section 8). For other years, (Section 8 current year) + (Section 10 prior year)																
		PG&E				307	1,253	2,211	3,137	4,169	5,125	6,139	7,148	8,165	8,356	8,640	8,929	9,223	9,521
		SCE				-	756	1,799	2,717	2,965	3,146	3,339	3,568	3,802	3,950	4,235	4,526	4,822	5,123
		SDG&E				-	-	-	80	319	554	792	1,037	1,297	1,546	1,825	2,114	2,412	2,721
		Total				307	2,009	4,009	5,934	7,453	8,825	10,269	11,753	13,263	13,851	14,700	15,568	16,456	17,365
		Cumulative MW with 50% CF				70	459	915	1,355	1,702	2,015	2,345	2,683	3,028	3,162	3,356	3,554	3,757	3,965
		PG&E DA				93	188	286	386	489	594	702	812	925	1,041	1,159	1,263	1,289	1,314
		SCE DA				127	259	394	534	677	825	978	1,135	1,297	1,463	1,634	1,786	1,829	1,873
		SDG&E				41	84	129	175	223	273	325	380	436	495	555	611	630	650
		Total DA				262	531	809	1,095	1,389	1,693	2,005	2,327	2,658	2,998	3,348	3,660	3,748	3,837
		Cumulative MW with 50% CF				60	121	185	250	317	386	458	531	607	685	764	836	856	876
		Total Rest of State				838	1,693	2,556	3,395	4,277	5,141	6,046	6,968	7,900	8,618	8,812	9,008	9,207	9,407
		Cumulative MW with 50% CF				191	387	583	775	976	1,174	1,380	1,591	1,804	1,967	2,012	2,057	2,102	2,148
					DA and IOU	Energy	2,540			8,843									21,202
						MW	580			2,019									4,841

Appendix A 060303 corrected.xls

Gray shading is explanatory.
Green shading is from CPUC filings or press releases regarding future procurements.
Purple shading is from CPUC fillings or press releases regarding the 2001 Baseline.

Print Date: 6/4/2003

Appendix A. Estimation of Energy Requirements to meet California's RPS by 2017

Staff's Outlook for California
Retail Sales by Utility (GWh)

	PG&E			SMUD	SCE			LADWP	SDG&E		BGP	OTH	DWR	TOTAL
Year	PG&E Customers	Municipal Sales in PG&E	Direct Access Sales in PG&E		SCE Customers	Municipal Sales in SCE	Direct Access Sales in SCE		SDG&E Customers	Direct Access Sales in SDG&E				
1980	54,908	10,658	0	5,350	53,465	5,870	0	17,669	9,729	0	2,374	2,677	3,354	166,056
1981	56,023	10,993	0	5,693	55,182	6,116	0	18,340	9,875	0	2,452	2,781	5,264	172,719
1982	54,767	10,548	0	5,681	53,313	5,696	0	18,184	9,812	0	2,399	2,660	5,192	168,252
1983	56,757	10,792	0	5,954	55,170	5,922	0	18,492	10,023	0	2,433	2,595	2,497	170,636
1984	60,616	11,851	0	6,360	58,745	6,761	0	19,438	10,616	0	2,644	2,722	3,349	183,102
1985	62,395	12,198	0	6,881	60,034	6,883	0	19,443	10,930	0	2,699	2,770	5,410	189,643
1986	61,071	11,637	0	7,014	61,125	6,943	0	19,671	11,363	0	2,695	2,758	5,031	189,308
1987	63,903	12,317	0	7,419	63,962	7,247	0	20,284	11,920	0	2,754	2,872	4,734	197,412
1988	66,006	12,733	0	7,677	66,251	7,428	0	20,719	12,713	0	2,861	3,055	5,928	205,371
1989	67,642	13,045	0	7,927	67,914	7,305	0	20,642	13,427	0	2,813	3,205	7,413	211,331
1990	69,445	13,369	0	8,358	70,464	7,901	0	20,953	14,331	0	2,951	3,310	8,171	219,254
1991	69,571	13,214	0	8,349	69,072	7,787	0	20,457	14,171	0	2,759	3,323	4,400	213,103
1992	70,671	13,467	0	8,496	71,087	7,545	0	20,945	15,093	0	2,931	3,513	4,088	217,837
1993	70,654	13,382	0	8,435	69,791	7,654	0	21,259	15,036	0	2,996	3,602	4,372	217,180
1994	70,733	13,350	0	8,418	71,117	7,952	0	20,308	15,381	0	2,999	3,758	4,946	218,962
1995	71,797	13,467	0	8,458	71,548	7,577	0	20,939	15,524	0	3,084	3,819	3,562	219,774
1996	73,273	13,746	0	8,805	73,766	8,029	0	21,228	16,046	0	3,152	3,983	5,146	227,174
1997	76,241	14,327	0	9,006	76,057	8,300	0	21,605	16,748	0	3,236	3,972	5,504	234,995
1998	70,121	14,364	5,559	9,123	70,097	8,189	6,161	21,412	13,609	3,641	3,298	3,911	3,421	232,905
1999	71,251	14,564	7,958	9,326	69,388	8,782	8,819	21,434	12,719	5,211	3,240	4,009	5,490	242,192
2000	73,387	15,039	8,396	9,491	74,130	9,108	9,304	22,146	12,926	5,498	3,320	4,227	5,490	252,464
2001	75,681	14,110	3,761	9,334	74,286	8,631	4,168	21,575	15,000	2,463	3,275	4,230	6,349	242,861
2002	69,950	13,925	8,321	9,429	65,450	8,537	11,088	21,724	14,394	3,423	3,343	4,196	7,889	241,668
2003	70,706	14,065	8,320	9,563	66,225	8,649	11,087	21,979	14,592	3,423	3,380	4,262	7,889	244,139
2004	72,496	14,455	8,427	9,729	68,146	8,896	11,267	22,248	14,947	3,498	3,429	4,381	7,889	249,809
2005	74,205	14,756	8,537	9,906	70,266	9,140	11,451	22,582	15,304	3,575	3,471	4,466	7,889	255,549
2006	75,748	15,033	8,647	10,060	72,054	9,352	11,638	22,846	15,666	3,654	3,504	4,580	7,889	260,671
2007	76,879	15,231	8,760	10,214	73,126	9,506	11,828	23,015	15,938	3,735	3,516	4,639	7,889	264,276
2008	78,530	15,509	8,873	10,388	74,365	9,673	12,021	23,211	16,348	3,818	3,530	4,740	7,889	268,895
2009	79,535	15,685	8,989	10,548	75,272	9,816	12,218	23,338	16,604	3,902	3,542	4,828	7,889	272,165
2010	80,751	15,895	9,106	10,710	76,234	9,963	12,417	23,515	16,826	3,989	3,555	4,979	7,889	275,829
2011	81,814	16,086	9,225	10,869	77,383	10,124	12,621	23,724	17,068	4,078	3,570	5,100	7,889	279,551
2012	82,812	16,262	9,345	11,022	78,550	10,287	12,827	23,885	17,363	4,168	3,582	5,257	7,889	283,252
2013	83,569	16,389	9,468	11,172	79,289	10,402	13,038	24,115	17,541	4,261	3,592	5,415	7,889	286,139
Annual Growth Rates (%)														
1980-1990	2.4	2.3		4.6	2.8	3.0		1.7	3.9		2.2	2.1	9.3	2.8
1990-2000	0.6	1.2		1.3	0.5	1.4		0.6	-1.0		1.2	2.5	-3.9	1.4
2000-2013	1.0	0.7		1.3	0.5	1.0		0.7	2.4		0.6	1.9	2.8	1.0
2003-2013	1.7	1.5	1.3	1.6	1.8	1.9	1.6	0.9	1.9	2.2	0.6	2.4	0.0	1.6

Historic Data through 2001

California Energy Demand 2003 - baseline forecast March 21, 2003

Appendix A. Estimation of Energy Requirements to meet California's RPS by 2017

Notes regarding the preparation of staff estimate of California retail sales:

The retail sales forecast is derived from the final electricity demand forecast developed for the Integrated Energy Policy Report (IEPR) that is currently under preparation. Staff forecasts electricity demand using models developed at the Energy Commission, with the exception of the industrial and mining sectors, for which the staff uses the INFORM model originally developed by the Electric Power Research Institute (EPRI). Each model develops a forecast using a complex series of calculations that simultaneously consider economic and demographic trends, weather characteristics, changes in energy utilization, regulatory conditions, and recorded consumption. Population and personal income are key drivers for the residential and commercial sectors. Employment and shipments are drivers for the commercial and industrial sectors.

Staff develops a forecast of households using the California Department of Finance population projections. Projections of personal income, shipments and employment are developed from the University of California at Los Angeles (UCLA) Anderson School of Business California forecast of September 2002. This forecast assumes that stronger economic growth will resume in late 2003, followed by steady growth, but at a lower rate than previous post-recession periods. A more detailed presentation of this forecast and assumptions will be published in a Technical Appendix to the IEPR. Descriptions of forecasting methods are also contained in “California Energy Demand: 1995-2015, Volume II Electricity Demand Forecasting Models”, July 1995, Publication Number P300-95-005.

The final demand forecast for the IEPR incorporate several changes as a result of comments received on the draft forecast presented at the February 26, 2003 IEPR workshop. Staff revised the electricity rate forecasts based on comments from utilities. Staff also updated the IOU’s present rates to reflect recent changes. Demand reductions from energy efficiency programs included in the forecast are now consistent with the assumption that the current level of program funding persists through 2011, as authorized by the legislature. In addition, staff modified the residential demand model to better estimate the effect of growth in personal income on residential consumption. The combined effect of these changes is to reduce average annual demand growth by 0.5 percent per year over the next ten years. The average growth rate of the final statewide electricity consumption forecast is 1.6% per year over the next ten years.

The Commission’s energy demand models produce forecasts of electricity consumption for eight utility planning areas. To develop a forecast of utility customer sales for Pacific Gas and Electric (PG&E), Southern California Edison (SCE) and San Diego Gas and Electric (SDG&E), three adjustments are made to the planning area forecast. First, electricity consumption needs that are privately supplied through self-generation or distributed generation are excluded. To forecast private supply, staff estimated peak load and consumption for 2002 and 2003 using data from PG&E, SCE and SDG&E on new interconnect activity in their territories. After 2003, privately supplied load is assumed to grow at one percent per year.

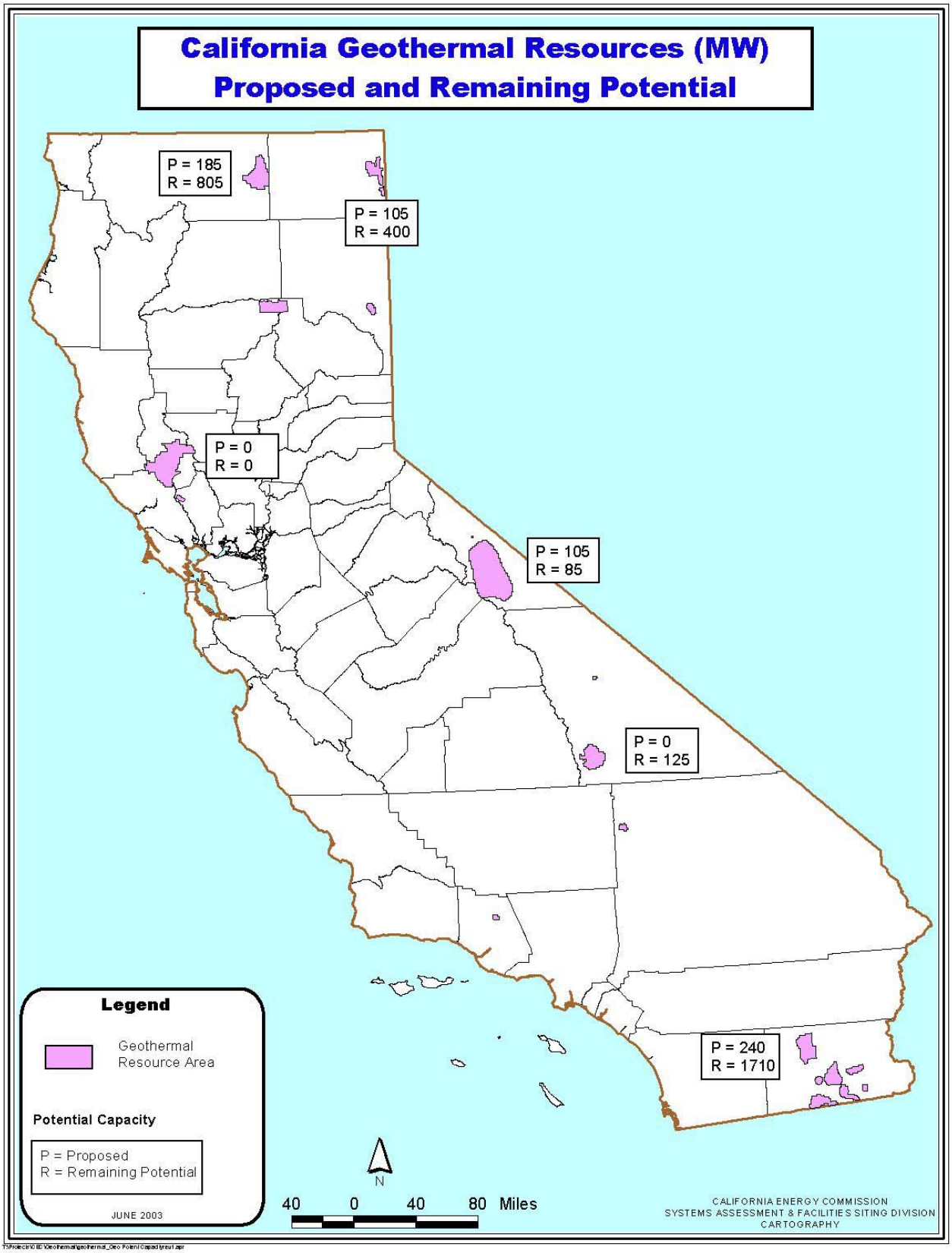
Second, staff used historic consumption data to allocate the planning area forecast between the utilities’ own customers, and water districts and municipalities (or resale cities) in that planning area.

Third, sales to direct access customers are subtracted from the utility customer forecast. To forecast direct access sales, staff used 2002 CPUC reports on actual direct access sales, and assumed that direct access demand grows at the same rate as the overall customer sector for that utility.

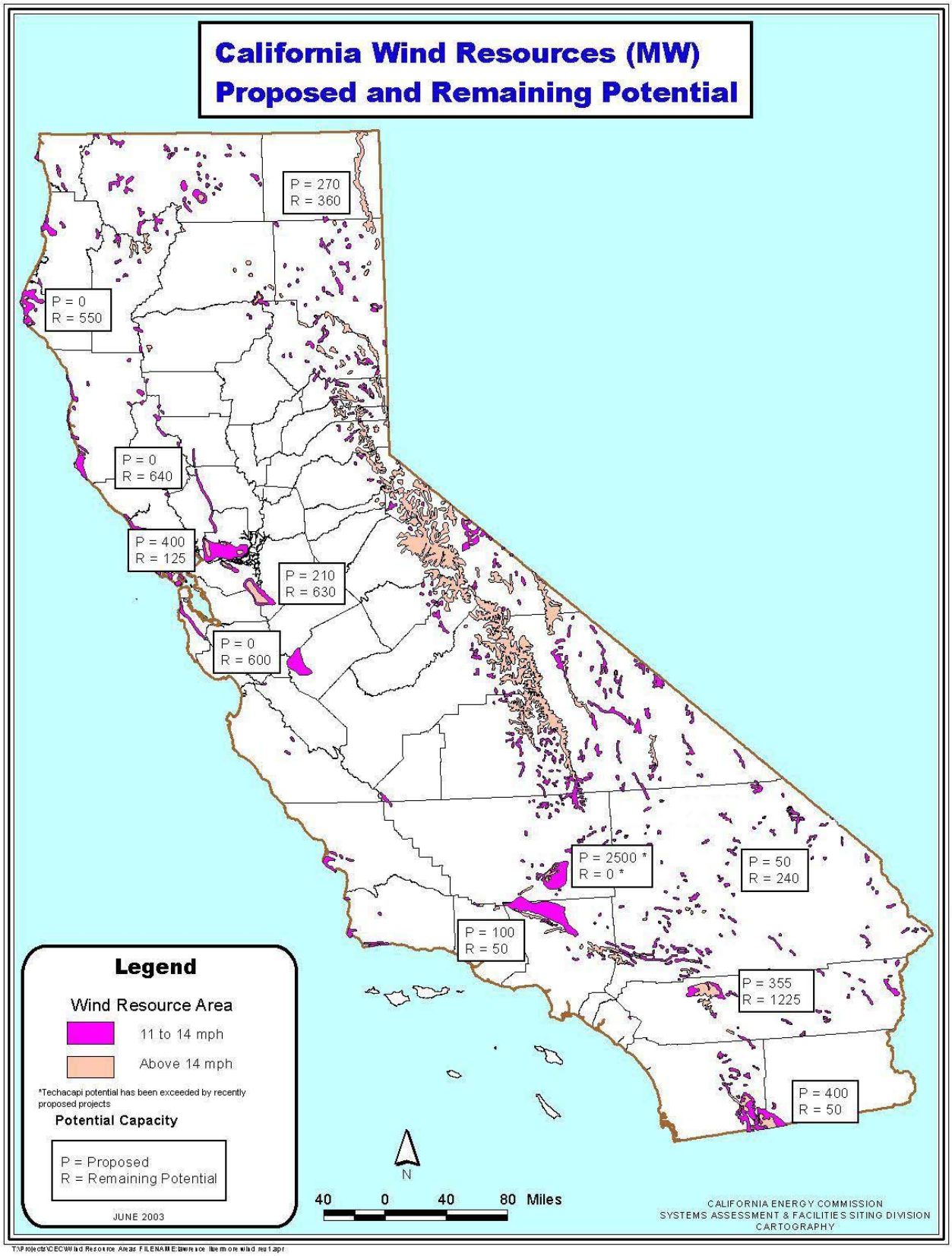
Appendix B. County Maps of California Technical Potential for Wind and Geothermal Energy

Map of California Counties

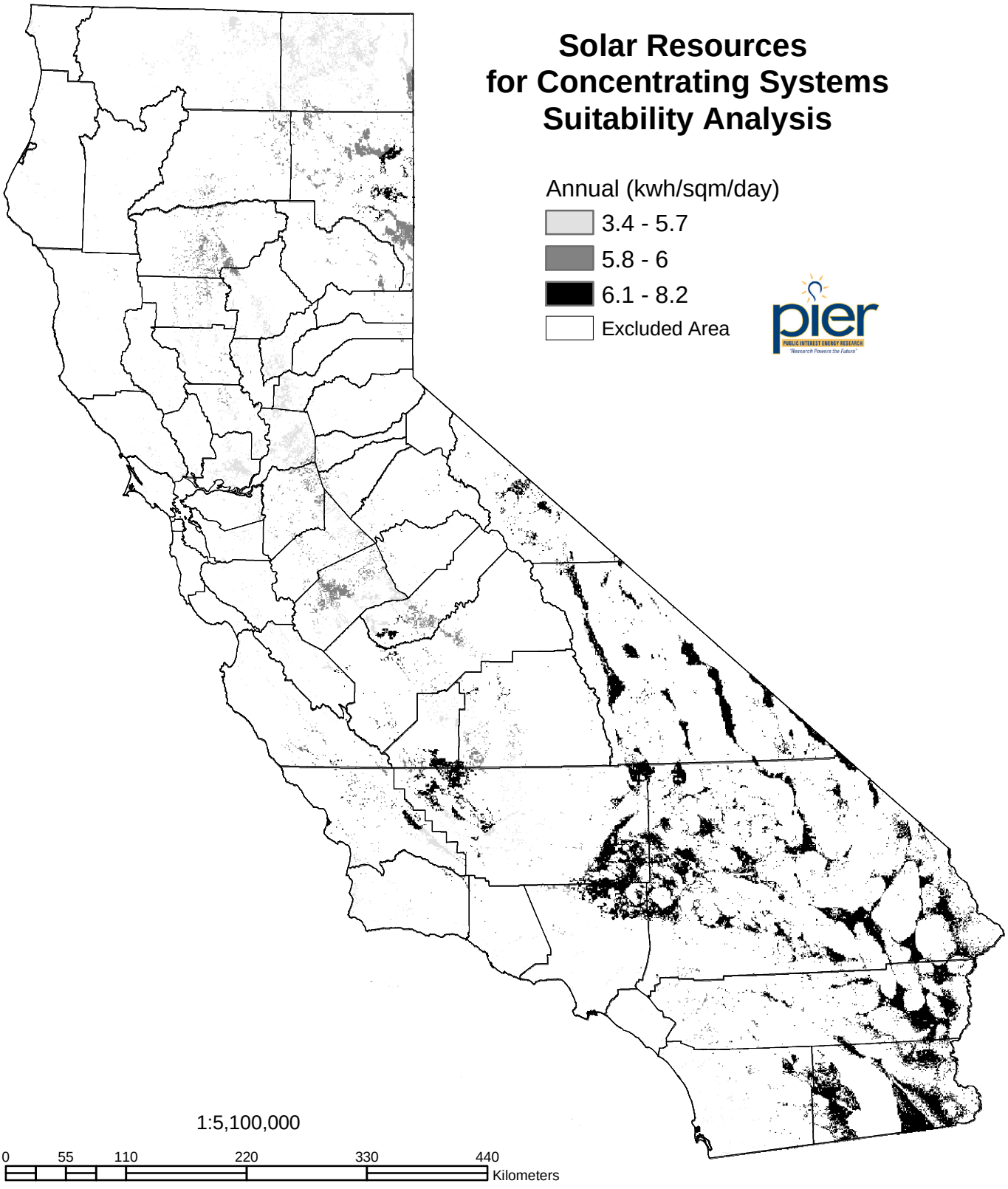
Appendix B. County Maps of California Technical Potential for Wind and Geothermal Energy



Appendix B. County Maps of California Technical Potential for Wind and Geothermal Energy



Appendix B. County Maps of California Technical Potential for Wind, Geothermal, and Solar Thermal Electric



Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

California's Existing and Proposed Renewable Energy in Comparison to Estimated RPS Requirements

California	GWh sales or generation	
Existing (IOU and ESP/CCAs)	19,549	
Existing (rest of state)	6,267	25,816
93% of Proposed (all CA)	23,619	23,619
2001 Baseline (IOU, ESP/CCA)	19,549	
Interim Procurment	3,644	
add by 2005	2,540	
add by 2008	6,300	
add by 2017	12,360	21,200

Existing (IOU, ESP/CCAs and rest of state)			
2001 Generation	% Loss	GWh loss	Sales
27,759	7%	1,943	25,816

The Energy Commission estimates that there were 27,759 GWhs of qualifying renewables generated in California in 2001. However, to convert renewable generation to renewable sales, a loss of 7% was applied to the generation figure.

Notes:

2001 Generation:
http://www.energy.ca.gov/electricity/generation_ownership.html

Existing (IOU and ESP/CCAs):
- Staff's Outlook for California - 2001 Retail Sales was prepared by Energy Commission Staff in the Demand Analysis Office.

PG&E - In a January 6, 2003 (R. 01-10-024) filing, PG&E calculated their 2001 percentage of power provided by eligible renewable power sources to be 10 percent of their total energy portfolio. Staff converted this total into energy, and used it for the energy figure. However, Staff used the Energy Commission's sales figure when calculating the percent of sales. For 2001, Staff estimated that PG&E sold 7,532 GWh of eligible renewable energy.

SCE - In a U-338 E filing on January 6, 2003 (R. 01-10-024), SCE indicates that their Renewable QFs in 2001 provided 10,610 GWh. Based on an analysis of SCE's FERC Form No. 1 data, Staff added an additional 550 GWh of small hydroelectric generation that potentially was not counted by SCE, but may qualify as part of SCE's 2001 renewable Baseline. For 2001, Staff estimated that SCE sold 11,160 GWh of eligible renewable energy.

SDG&E - In a January 6, 2003 filing (R. 01-10-024), SDG&E indicates that their renewable energy sales in 2003 will be 4.5% and in 2004 7.1% of total retail sales. Also, SDG&E indicates that for 2003, 3.76% of the 4.5% will be additional renewables, per the Interim Procurement requirement. While it is difficult to subtract percentages across years and get a reliable energy figure, Staff did just that and assumed that in 2001, SDG&E had 0.74% of their total sales come from renewables. In terms of energy, for 2001 Staff estimated that SDG&E sold 112 GWh of eligible renewable energy.

Existing (rest of state)
"2001 Generation" converted to sales minus "Existing (IOU and ESP/CCAs)"

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

California's Existing and Proposed Renewable Energy in Comparison to Estimated RPS Requirements

Proposed (all CA):
Data on proposed projects were gathered from solicitations for new electric providers to IOU and/or municipal electric utilities. The following data sources were used: the Energy Commission's New Renewable Resources Account database, California Power Authority Letters of Intent, Southern California Public Power Authority (SCPPA) Request for Proposals (RFP), Bonneville Power Authority (BPA) Transmission Information database (OASIS), the Sierra Pacific RFP, and Foresight Energy's ongoing review of press releases and other data sources. Data for proposed projects within California rely on publicly available information from the IOU Interim Procurements and exclude information from the NCPA solicitation. This information will be updated for the Renewable Resource Development Report.

2001 Baseline (IOU, ESP/CCA):
"Existing (IOU and ESP/CCAs)" plus paid 2001 Energy Commission Customer Credit GWh.

Interim Procurment:

PG&E - In their Advice letter dated January 2, 2003 (2334-E), PG&E indicated they would procure approximately 826 GWh/year beginning in 2003 for their Interim Procurement requirement.

SCE - In a January 2, 2003 filing, SCE indicated they would procure at least 748 GWh/year beginning in 2003 for their Interim Procurement requirement.

SDG&E - In a January 6, 2003 filing (R. 01-10-024), SDG&E indicates that their renewable energy sales in 2003 will be 4.5% and in 2004 7.1% of total retail sales. Also, SDG&E indicates that for 2003, 3.76% of the 4.5% will be additional renewables, per the Interim Procurement requirement. While it is difficult to subtract percentages across years and get a reliable energy figure, Staff did just that and assumed that in 2001, SDG&E had 0.74% of their total sales come from renewables. In terms of energy, for 2001 Staff estimated that SDG&E sold 112 GWh of eligible renewable energy.

ESP/CCAs:
This analysis assumes that the ESP/CCAs procured a net increase of one-percent of their retail sales in 2003. Thus, each ESP/CCA jumped from an assumed 2001 Baseline of 7.17% to 8.17%. See Appendix A.

add by 2005	See Appendix A
add by 2008	See Appendix A
add by 2017	See Appendix A

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Online MW (Existing and Available as of End of 2002)

		Wind	Geothermal	Biomass Total	Solar Thermal	Biomass	Digester Gas	LFG	MSW/Tire	Biofuel	TOTAL	Notes
TOTAL MW		1,935	2,187	986	354	720	0	250	16	-	5,461	
Avg. Cap Factor		25%	90%	71%	27%	65%	80%	90%	70%	90%	60%	Effective Capacity Factors Calculated
Online Avail GWh		4,237	17,242	6,168	837	4,097	2	1,970	99	-	28,483	for Total Biomass and Grand Total
County												
Alameda	PG&E	395		7				7			401	
Alpine				-							-	
Amador	PG&E			34		18			16		34	
Butte	PG&E			-							-	
Calaveras				-							-	
Colusa	PG&E			27		27					27	
Contra Costa	PG&E	104		3				3			107	
Del Norte				-							-	
El Dorado	PG&E			-							-	
Fresno	PG&E			94		94					94	
Glenn				-							-	
Humbolt				56		56					56	
Imperial	SDG&E		795	-							795	
Inyo	SCE		306	-							306	
Kern	SCE	747	160	57	150	57					1,114	
Kings				-							-	
Lake	PG&E		752	-							752	
Lassen			3	79		79					82	
Los Angeles	SCE			137				137			137	
Madera				-							-	
Marin				-							-	
Maripos				-							-	
Mendocino				15		15					15	
Merced	PG&E	34		13		13					47	
Modoc	Pacificorp			-							-	
Mono	SCE		108	-							108	
Monterey	PG&E			27				27			27	
Napa				-							-	
Nevada				-							-	
Orange	SCE			36				36			36	
Placer	PG&E			31		29		1			31	
Plumas				32		32					32	
Riverside	SCE	502	19	51		50		1			571	
Sacramento				-							-	
San Benito				-							-	
San Bernardino	SCE	8		-	204						212	
San Diego				8				8			8	
San Francisco	PG&E			-							-	
San Joaquin		145		22		21		1			167	
San Luis Obisbo				-							-	
San Mateo	PG&E			2				2			2	
Santa Barbara	PG&E			3				3			3	
Santa Clara	PG&E			11				11			11	
Santa Cruz	PG&E			1				1			1	
Shasta	Pacificorp			127		127					127	
Sierra				20		20					20	

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Online MW (Existing and Available as of End of 2002)

		Wind	Geothermal	Biomass Total	Solar Thermal	Biomass	Digester Gas	LFG	MSW/Tire	Biofuel	TOTAL	Notes
TOTAL MW		1,935	2,187	986	354	720	0	250	16	-	5,461	
Avg. Cap Factor		25%	90%	71%	27%	65%	80%	90%	70%	90%	60%	Effective Capacity Factors Calculated
Online Avail GWh		4,237	17,242	6,168	837	4,097	2	1,970	99	-	28,483	for Total Biomass and Grand Total
Siskiyou	Pacificorp			-							-	
Solano	PG&E			2				2			2	
Sonoma			45	6				6			51	
Stanislaus				32		32					32	
Sutter				-							-	
Tehema	PG&E			4		4					4	
Trinity				-							-	
Tulare	SCE			42		39	0	2			42	
Tuolumne	PG&E			8		8					8	
Ventura				-							-	
Yolo	PG&E			5				5			5	
Yuba				-							-	
SP 15 (unknown)	SCE			-							-	
NP 15 (unknown)	PG&E			-							-	

Notes:

Data on existing resources were gathered from three sources: the Energy Commission's Existing Renewable Facilities Program database, the Energy Commission's New Renewable Resources Account database and the U.S. DOE Energy Efficiency and Renewable Energy (EERE) database, which is called the Renewable Electronic Plant Information System (REPiS).

The Energy Commission annually publishes the "J-11" table, which details the amount of generation from specific resource types (i.e. GWh from Nuclear or GWh from Geothermal). The J-11 data were used to estimate the 2001 baseline for the "rest of the state" (i.e., not IOU, not ESP/CCA) retail sales. J-11 data for 2001 total 27,759 GWh. The breakdown (in GWh) between resources is: Geothermal - 13,619; Organic Waste (biomass) - 6,185; Wind - 3,242; Solar - 837; and Small Hydro (under 30 MW) - 3,876. J-11 data is actual data for a specific year. Where the analysis called for an estimate of average renewable energy generation, J-11 was not

This analysis gathered data on existing on-line facilities in California and the WECC during the end of 2002. To convert from MW to GWh, the following capacity factors were applied: Wind - 25%; Geothermal - 90%; Biomass - 71% in California and 69% in the WECC; and Solar Thermal - 27%. The figures produced using these capacity factors are meant to provide an approximate average amount of energy these facilities could generate each year. Actual performance will vary year to year.

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Online GWh/year by County and Resource (Estimated based on MW existing and available in end of 2002)

	Wind	Geothermal	Biomass Total	Solar Thermal	Biomass	Digester Gas	LFG	MSW/Tire	Biofuel	TOTAL	Excluding Solar Thermal
TOTAL GWh	4,237	17,242	6,168	837	4,097	2	1,970	99	-	28,483	27,646
Avg. Cap Factor	25%	90%	71%	27%	65%	80%	90%	70%	90%	60%	
County											
Alameda	864	-	52	-	-	-	52	-	-	916	
Alpine	-	-	-	-	-	-	-	-	-	-	
Amador	-	-	201	-	102	-	-	99	-	201	
Butte	-	-	-	-	-	-	-	-	-	-	
Calaveras	-	-	-	-	-	-	-	-	-	-	
Colusa	-	-	151	-	151	-	-	-	-	151	
Contra Costa	228	-	24	-	-	-	24	-	-	251	
Del Norte	-	-	-	-	-	-	-	-	-	-	
El Dorado	-	-	-	-	-	-	-	-	-	-	
Fresno	-	-	535	-	535	-	-	-	-	535	
Glenn	-	-	-	-	-	-	-	-	-	-	
Humbolt	-	-	319	-	319	-	-	-	-	319	
Imperial	-	6,266	-	-	-	-	-	-	-	6,266	
Inyo	-	2,409	-	-	-	-	-	-	-	2,409	
Kern	1,635	1,261	325	355	325	-	-	-	-	3,576	
Kings	-	-	-	-	-	-	-	-	-	-	
Lake	-	5,932	-	-	-	-	-	-	-	5,932	
Lassen	-	24	450	-	450	-	-	-	-	473	
Los Angeles	-	-	1,080	-	-	-	1,080	-	-	1,080	
Madera	-	-	-	-	-	-	-	-	-	-	
Marin	-	-	-	-	-	-	-	-	-	-	
Maripos	-	-	-	-	-	-	-	-	-	-	
Mendocino	-	-	85	-	85	-	-	-	-	85	
Merced	74	-	71	-	71	-	-	-	-	146	
Modoc	-	-	-	-	-	-	-	-	-	-	
Mono	-	848	-	-	-	-	-	-	-	848	
Monterey	-	-	209	-	-	-	209	-	-	209	
Napa	-	-	-	-	-	-	-	-	-	-	

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Online GWh/year by County and Resource (Estimated based on MW existing and available in end of 2002)

	Wind	Geothermal	Biomass Total	Solar Thermal	Biomass	Digester Gas	LFG	MSW/Tire	Biofuel	TOTAL	Excluding Solar Thermal
TOTAL GWh	4,237	17,242	6,168	837	4,097	2	1,970	99	-	28,483	27,646
Avg. Cap Factor	25%	90%	71%	27%	65%	80%	90%	70%	90%	60%	
County											
Nevada	-	-	-	-	-	-	-	-	-	-	
Orange	-	-	284	-	-	-	284	-	-	284	
Placer	-	-	177	-	167	-	9	-	-	177	
Plumas	-	-	182	-	182	-	-	-	-	182	
Riverside	1,100	147	289	-	285	-	5	-	-	1,536	
Sacramento	-	-	-	-	-	-	-	-	-	-	
San Benito	-	-	-	-	-	-	-	-	-	-	
San Bernardino	18	-	-	482	-	-	-	-	-	500	
San Diego	-	-	60	-	-	-	60	-	-	60	
San Francisco	-	-	-	-	-	-	-	-	-	-	
San Joaquin	317	-	126	-	120	-	6	-	-	443	
San Luis Obisbo	-	-	-	-	-	-	-	-	-	-	
San Mateo	-	-	16	-	-	-	16	-	-	16	
Santa Barbara	-	-	22	-	-	-	22	-	-	22	
Santa Clara	-	-	84	-	-	-	84	-	-	84	
Santa Cruz	-	-	5	-	-	-	5	-	-	5	
Shasta	-	-	722	-	722	-	-	-	-	722	
Sierra	-	-	114	-	114	-	-	-	-	114	
Siskiyou	-	-	-	-	-	-	-	-	-	-	
Solano	-	-	12	-	-	-	12	-	-	12	
Sonoma	-	355	47	-	-	-	47	-	-	402	
Stanislaus	-	-	182	-	182	-	-	-	-	182	
Sutter	-	-	-	-	-	-	-	-	-	-	
Tehema	-	-	22	-	22	-	-	-	-	22	
Trinity	-	-	-	-	-	-	-	-	-	-	
Tulare	-	-	243	-	222	2	19	-	-	243	
Tuolumne	-	-	43	-	43	-	-	-	-	43	
Ventura	-	-	-	-	-	-	-	-	-	-	

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Online GWh/year by County and Resource (Estimated based on MW existing and available in end of 2002)

	Wind	Geothermal	Biomass Total	Solar Thermal	Biomass	Digester Gas	LFG	MSW/Tire	Biofuel	TOTAL	Excluding Solar Thermal
TOTAL GWh	4,237	17,242	6,168	837	4,097	2	1,970	99	-	28,483	27,646
Avg. Cap Factor	25%	90%	71%	27%	65%	80%	90%	70%	90%	60%	
County											
Yolo	-	-	37	-	-	-	37	-	-	37	
Yuba	-	-	-	-	-	-	-	-	-	-	
SP 15 (unknown)	-	-	-	-	-	-	-	-	-	-	
NP 15 (unknown)	-	-	-	-	-	-	-	-	-	-	

Notes:

Data on existing resources were gathered from three sources: the Energy Commission's Existing Renewable Facilities Program database, the Energy Commission's New Renewable Resources Account database and the U.S. DOE Energy Efficiency and Renewable Energy (EERE) database. To convert from estimated MW to estimated energy, the following capacity factors were assumed: wind 25%, geothermal 90%, biomass 71% and solar thermal 27%.

The Energy Commission annually publishes the "J-11" table, which details the amount of generation from specific resource types (i.e. GWh from Nuclear or GWh from Geothermal). The J-11 data were used to estimate the 2001 baseline for the "rest of the state" (i.e., not IOU, not ESP/CCA) retail sales. J-11 data for 2001 total 27,759 GWh. The breakdown (in GWh) between resources is: Geothermal - 13,619; Organic Waste (biomass) - 6,185; Wind - 3,242; Solar - 837; and Small Hydro (under 30 MW) - 3,876. J-11 data is actual data for a specific year. Where the analysis called for an estimate of average renewable energy generation, J-11 was not used.

This analysis gathered data on existing on-line facilities in California and the WECC during the end of 2002. To convert from MW to GWh, the following capacity factors were applied: Wind - 25%; Geothermal - 90%; Biomass - 71% in California and 69% in the WECC; and Solar Thermal - 27%. The figures produced using these capacity factors are meant to provide an approximate average amount of energy these facilities could generate each year. Actual performance will vary year to year.

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Electricity Produced from Existing Renewable Energy Resources in California's Top 19 Counties (by Utility Distribution Company - UDC)
GWh

	Total	Wind	Geothermal	Biomass	Solar
Imperial	6,266	-	6,266	-	-
Kern	3,576	1,635	1,261	325	355
Orange	284	-	-	284	-
Riverside	1,536	1,100	147	289	-
Los Angeles	1,080	-	-	1,080	-
Inyo	2,409	-	2,409	-	-
Mono	848	-	848	-	-
San Bernardino	500	18	-	-	482
Modoc	-	-	-	-	-
Lake	5,932	-	5,932	-	-
Alameda	916	864	-	52	-
Humbolt	319	-	-	319	-
Merced	146	74	-	71	-
Siskiyou	-	-	-	-	-
Napa	-	-	-	-	-
Solano	12	-	-	12	-
Fresno	535	-	-	535	-
San Joaquin	443	317	-	126	-
San Diego	60	-	-	60	-

Notes:

While all counties have *some* renewable potential, the above 19 were deemed to have the greatest potential, and thus, were highlighted for this analysis.

Data on existing resources were gathered from three sources: the Energy Commission's Existing Renewable Facilities Program database, the Energy Commission's New Renewable Resources Account database and the U.S. DOE Energy Efficiency and Renewable Energy (EERE) database. To convert from estimated MW to estimated energy, the following capacity factors were assumed: wind 25%, geothermal 90%, biomass 71% and solar thermal 27%.

The Energy Commission annually publishes the "J-11" table, which details the amount of generation from specific resource types (i.e. GWh from Nuclear or GWh from Geothermal). The J-11 data were used to estimate the 2001 baseline for the "rest of the state" (i.e., not IOU, not ESP/CCA) retail sales. J-11 data for 2001 total 27,759 GWh. The breakdown (in GWh) between resources is: Geothermal - 13,619; Organic Waste (biomass) - 6,185; Wind - 3,242; Solar - 837; and Small Hydro (under 30 MW) - 3,876. J-11 data is actual data for a specific year. Where the

This analysis gathered data on existing on-line facilities in California and the WECC during the end of 2002. To convert from MW to GWh, the following capacity factors were applied: Wind - 25%; Geothermal - 90%; Biomass - 71% in California and 69% in the WECC; and Solar Thermal - 27%. The figures produced using these capacity factors are meant to provide an approximate average amount of energy these facilities could generate each year. Actual performance will vary year to year.

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Proposed CA MW		Wind	Geo-thermal	Biomass Total	Solar Thermal	Biomass	Digester Gas	LFG	MSW/Tire	Biofuel	TOTAL
TOTAL MW		5,335	883	481	120	135	9	107	30	200	6,819
Assumed Cap Factor		35%	90%	80%	15%	80%	80%	80%	80%	80%	45%
Proposed Avail GWh		16,357	6,962	3,374	158	945	65	752	210	1,402	26,850
County	**Utility**										
Alameda	PG&E	210.0		4.5				4.5			215
Alpine											-
Amador	PG&E			-							-
Butte											-
Calaveras											-
Colusa	PG&E			25.5		25.5					26
Contra Costa	PG&E			3.9				3.9			4
Del Norte											-
El Dorado	PG&E			1.0				1.0			1
Fresno	PG&E			2.6				2.6			3
Glenn											-
Humbolt											-
Imperial	SDG&E		240.0	80.0		50.0			30.0		320
Inyo	SCE			-							-
Kern	SCE	3,790.0		-							3,790
Kings											-
Lake	PG&E			-							-
Lassen											-
Los Angeles	SCE	100.0		78.0		50.0		28.0			178
Madera											-
Marin											-
Mariposa											-
Mendocino											-
Merced	PG&E			-							-
Modoc	Pacificorp		105.0	-							105
Mono	SCE	30.0	350.0	-							380
Monterey	PG&E			1.0				1.0			1
Napa											-
Nevada											-
Orange	SCE			2.0				2.0			2
Placer	PG&E			-							-
Plumas											-
Riverside	SCE	354.0		8.0				8.0			362
Sacramento											-
San Benito											-
San Bernardino	SCE	51.0		18.8	120.0	1.5		17.3			190

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Proposed CA MW		**Wind**	**Geo-thermal**	**Biomass Total**	**Solar Thermal**	**Biomass**	**Digester Gas**	**LFG**	**MSW/Tire**	**Biofuel**	**TOTAL**
TOTAL MW		5,335	883	481	120	135	9	107	30	200	6,819
Assumed Cap Factor		35%	90%	80%	15%	80%	80%	80%	80%	80%	45%
Proposed Avail GWh		16,357	6,962	3,374	158	945	65	752	210	1,402	26,850
County	**Utility**										
San Diego	SDG&E	400.0		10.9				10.9			411
San Francisco	PG&E			2.1			2.1				2
San Joaquin											-
San Luis Obisbo											-
San Mateo	PG&E			19.0				19.0			19
Santa Barbara	PG&E			-							-
Santa Clara	PG&E			5.5				5.5			6
Santa Cruz	PG&E			2.0				2.0			2
Shasta	Pacificorp			-							-
Sierra											-
Siskiyou	Pacificorp		188.0	-							188
Solano	PG&E	400.0		-							400
Sonoma											-
Stanislaus											-
Sutter											-
Tehema	PG&E			-							-
Trinity											-
Tulare	SCE			1.6				1.6			2
Tuolumne	PG&E			-							-
Ventura											-
Yolo	PG&E			7.8		7.8					8
Yuba											-
NP 15 (unknown)	PG&E			200.0						200.0	200
SP 15 (unknown)	SCE			7.2			7.2				7

Notes:

Effective Capacity Factors Calculated for Total Biomass and Grand Total

The data for the proposed projects date back as far as June 1998 from the Energy Commission's first New Account auction to as recent as projects participating in the 2003 Interim Procurement. A limited amount of projects were filtered out if they did not appear to be plausible or "real" projects. Most of the proposed projects do not have contracts and are not yet under construction.

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Proposed CA GWh By County and Resource

	Wind	Geo-thermal	Biomass Total	Solar Thermal	Biomass	Digester Gas	LFG	MSW/ Tire	Biofuel	TOTAL	excludes solar		Total by utility excludes NP15, SP15
TOTAL GWh	16,357	6,961	1,922	158	945	15	752	210	-	25,397	25,240	check	25,397
Assumed Cap Factor	35%	90%	80%	15%	80%	80%	80%	80%	80%	45%			
County													
Imperial	-	1,892	561	-	350	-	-	210	-	2,453	2,453	IID	2,453
PG&E													4,705
Alameda	644	-	32	-	-	-	32	-	-	675	675	PG&E	
Alpine	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Amador	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Butte	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Calaveras	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Colusa	-	-	179	-	179	-	-	-	-	179	179	PG&E	
Contra Costa	-	-	27	-	-	-	27	-	-	27	27	PG&E	
Del Norte	-	-	-	-	-	-	-	-	-	-	-	PG&E	
El Dorado	-	-	7	-	-	-	7	-	-	7	7	PG&E	
Fresno	-	-	18	-	-	-	18	-	-	18	18	PG&E	
Glenn	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Humbolt	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Kings	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Lake	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Lassen	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Madera	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Marin	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Mariposa	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Mendocino	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Merced	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Modoc	-	828	-	-	-	-	-	-	-	828	828	PG&E	
Monterey	-	-	7	-	-	-	7	-	-	7	7	PG&E	
Napa	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Nevada	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Placer	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Plumas	-	-	-	-	-	-	-	-	-	-	-	PG&E	
San Benito	-	-	-	-	-	-	-	-	-	-	-	PG&E	
San Francisco	-	-	15	-	-	15	-	-	-	15	15	PG&E	
San Joaquin	-	-	-	-	-	-	-	-	-	-	-	PG&E	
San Luis Obisbo	-	-	-	-	-	-	-	-	-	-	-	PG&E	
San Mateo	-	-	133	-	-	-	133	-	-	133	133	PG&E	
Santa Clara	-	-	39	-	-	-	39	-	-	39	39	PG&E	
Santa Cruz	-	-	14	-	-	-	14	-	-	14	14	PG&E	
Shasta	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Sierra	-	-	-	-	-	-	-	-	-	-	-	PG&E	

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Proposed CA GWh By County and Resource

	Wind	Geo-thermal	Biomass Total	Solar Thermal	Biomass	Digester Gas	LFG	MSW/ Tire	Biofuel	TOTAL	excludes solar	Total by utility excludes NP15, SP15	
TOTAL GWh	16,357	6,961	1,922	158	945	15	752	210	-	25,397	25,240	check	25,397
Assumed Cap Factor	35%	90%	80%	15%	80%	80%	80%	80%	80%	45%			
County													
Siskiyou	-	1,482	-	-	-	-	-	-	-	1,482	1,482	PG&E	
Solano	1,226	-	-	-	-	-	-	-	-	1,226	1,226	PG&E	
Sonoma	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Stanislaus	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Sutter	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Tehema	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Trinity	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Tuolumne	-	-	-	-	-	-	-	-	-	-	-	PG&E	
Yolo	-	-	55	-	55	-	-	-	-	55	55	PG&E	
Yuba	-	-	-	-	-	-	-	-	-	-	-	PG&E	
													16,937
Inyo	-	-	-	-	-	-	-	-	-	-	-	SCE	
Kern	11,620	-	-	-	-	-	-	-	-	11,620	11,620	SCE	
Los Angeles	307	-	547	-	350	-	196	-	-	853	853	SCE	
Mono	92	2,759	-	-	-	-	-	-	-	2,851	2,851	SCE	
Orange	-	-	14	-	-	-	14	-	-	14	14	SCE	
Riverside	1,085	-	56	-	-	-	56	-	-	1,141	1,141	SCE	
San Bernardino	156	-	132	158	11	-	121	-	-	446	288	SCE	
Santa Barbara	-	-	-	-	-	-	-	-	-	-	-	SCE	
Tulare	-	-	11	-	-	-	11	-	-	11	11	SCE	
Ventura	-	-	-	-	-	-	-	-	-	-	-	SCE	
San Diego	1,226	-	76	-	-	-	76	-	-	1,303	1,303	SDG&E	1,303
Sacramento	-	-	-	-	-	-	-	-	-	-	-	SMUD	
Totals (includes solar)	16,357	6,961	1,922	158	945	15	752	210	-	25,397	25,240		25,397

Notes:

Data on proposed projects were gathered from solicitations for new electric providers to IOU and/or municipal electric utilities. The following data sources were used: the Energy Commission's New Renewable Resources Account database, California Power Authority Letters of Intent, Southern California Public Power Authority (SCPPA) Request for Proposals (RFP), Bonneville Power Authority (BPA) Transmission Information database (OASIS), the Sierra Pacific RFP, and Foresight Energy's ongoing review of press releases and other data sources. Data for proposed projects within California rely on publicly available information from the IOU Interim Procurements and exclude information from the NCPA solicitation. The proposed MW were converted to energy using the following capacity factors: wind 35%, geothermal 90%, biomass 80% and solar thermal 15%. The data for the proposed projects date back as far as June 1998 from the Energy Commission's first New Account auction to as recent as known projects participating in the 2003 Interim Procurement. A limited amount of projects were filtered out if they did not appear to be plausible or "real" projects. Most of the proposed projects do not have contracts and are not yet under construction.

Excludes proposed projects listed solely as "NP 15" or "SP 15."

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Proposed Renewable Generation in California's Top 19 Counties (by UDC)

	Proposed					
	Wind	**Geothermal**	**Biomass**	**Solar**	**Totals**	
Imperial	-	1,892	561		2,453	
					SCE	16,926
Kern	11,620	-	-		11,620	
Orange	-	-	14		14	
Riverside	1,085	-	56		1,141	
Los Angele	307	-	547		853	
Inyo	-	-	-		-	
Mono	92	2,759	-		2,851	
San Bernar	156	-	132	158	446	
					PG&E	4,230
Modoc	-	828	-		828	
Lake	-	-	-		-	
Alameda	644	-	32		675	
Humbolt	-	-	-		-	
Merced	-	-	-		-	
Siskiyou	-	1,482	-		1,482	
Napa	-	-	-		-	
Solano	1,226	-	-		1,226	
Fresno	-	-	18		18	
San Joaqu	-	-	-		-	
						SDG&E
San Diego	1,226	-	76		1,303	
	16,357	6,961	1,435	158		

Notes:

While all counties have some renewable potential, the above 19 were deemed to have the greatest potential, and thus, were highlighted for this analysis.

Data on proposed projects were gathered from solicitations for new electric providers to IOU and/or municipal electric utilities. The following data sources were used: the Energy Commission's New Renewable Resources Account database, California Power Authority Letters of Intent, Southern California Public Power Authority (SCPPA) Request for Proposals (RFP), Bonneville Power Authority (BPA) Transmission Information database (OASIS), the Sierra Pacific RFP, and Foresight Energy's ongoing review of press releases and other data sources. Data for proposed projects within California rely on publicly available information from the IOU Interim Procurements and exclude information from the NCPA solicitation.

The proposed MW were converted to energy using the following capacity factors: wind 35%, geothermal 90%, biomass 80% and solar thermal 15%.

The data for the proposed projects date back as far as June 1998 from the Energy Commission's first New Account auction to as recent as known projects participating in the 2003 Interim Procurement. A limited amount of projects were filtered out if they did not appear to be plausible or "real" projects. Most of the proposed projects do not have contracts and are not yet under construction.

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Technical Potential MW - From RER

	Wind	Geothermal	Biomass	Subtotal		Solar	Total
Total MW	**8,906**	**6,141**	**4,066**	**19,113**		**75,610**	**94,723**
Avg CF	35%	90%	80%	62%		15%	25%
Total GWh	27,306	48,416	28,495	104,216		99,352	**203,568**
County							
ALAMEDA	1,121	0	88	1,209		402	1,611
ALPINE	0	0	0	0		0	1
AMADOR	4	0	15	19		10	29
BUTTE	10	0	111	121		57	178
CALAVERAS	3	0	25	28		11	39
COLUSA	6	80	81	167		5	172
CONTRA	26	0	45	71		264	335
DEL NORTE	7	0	23	30		8	38
EL DORADO	26	0	58	84		43	127
FRESNO	45	0	216	261		224	484
GLENN	8	0	74	82		7	90
HUMBOLDT	552	0	198	750		35	785
IMPERIAL	75	2,741	36	2,852		11,121	13,973
INYO	4	431	0	435		5	441
KERN	1,152	10	186	1,348		15,850	17,199
KINGS	2	0	92	94		37	131
LAKE	16	236	7	259		16	276
LASSEN	9	13	31	53		10	63
LOS	151	0	521	672		7,365	8,036
MADERA	11	0	56	67		35	101
MARIN	15	0	6	21		69	90
MARIPOSA	3	0	2	5		5	10
MENDOCINO	25	0	85	110		24	134
MERCED	632	0	95	727		59	786
MODOC	626	502	25	1,153		3	2,140
MONO	2	298	0	300		4	304
MONTEREY	12	0	25	37		112	149
NAPA	636	13	11	660		35	694
NEVADA	20	0	26	46		25	72
ORANGE	16	807	167	990		792	1,783
PLACER	29	0	28	57		69	125
PLUMAS	6	15	77	98		6	104
RIVERSIDE	1,939	0	120	2,059		8,377	10,436
SACRAMENT	4	0	90	94		340	435
SAN BENITO	4	0	4	8		15	23
SAN	297	0	120	417		24,619	25,035
SAN DIEGO	448	0	155	603		2,137	2,740
SAN	22	0	16	38		216	253
SAN	176	0	131	307		157	464

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Technical Potential MW - From RER

	Wind	Geothermal	Biomass	Subtotal		Solar	Total
Total MW	**8,906**	**6,141**	**4,066**	**19,113**		**75,610**	**94,723**
Avg CF	35%	90%	80%	62%		15%	25%
Total GWh	27,306	48,416	28,495	104,216		99,352	**203,568**
County							
SAN LUIS	9	0	14	23		1,342	1,365
SAN MATEO	19	0	32	51		197	248
SANTA	20	0	18	38		111	149
SANTA	10	0	72	82		469	551
SANTA CRUZ	12	0	22	34		71	105
SHASTA	25	0	75	100		45	145
SIERRA	1	0	20	21		1	23
SISKIYOU	13	984	102	1,099		12	128
SOLANO	524	0	37	561		110	671
SONOMA	9	0	49	58		128	185
STANISLAUS	16	0	88	104		125	228
SUTTER	0	0	61	61		22	83
TEHAMA	12	0	61	73		16	89
TRINITY	4	0	36	40		4	43
TULARE	36	0	153	189		103	292
TUOLUMNE	12	0	31	43		15	58
VENTURA	40	11	41	92		210	302
YOLO	3	0	57	60		47	106
YUBA	2	0	47	49		17	66
	8907	6141	4062	19110		75614	94723

Effective Capacity Factors Calculated for Subtotal and Grand Total

Notes:

A high-level assessment of renewable energy potential in the WECC published in July 2002 by the Land and Water Fund of the Rockies was used as the primary data source for technical potential for the Western Electricity Coordinating Council (WECC) region: Renewable Energy Atlas of the West: A Guide to the Region's Resource Potential. California specific data comes in part from the Regional Economic Research, Technical Potential of Renewable Resource Technologies, published in June 2002, which was used as a standard against which other data for California were measured.

Data on technical potential was drawn from the following sources: (1) Technology Potential of Renewable Resource Technologies, RER, June 2002; (2) Renewable Energy Atlas of the West, Land and Water Fund of the Rockies; (3) Generating Solutions, Environment California, 2003; (4) Renewable Energy for California, Renewable Energy Policy Project, March 2002; (5) Fuel from the Sky, NREL, July 2002;
(6) Assessment of the Available Windy Land Area and Wind Energy Potential in the U.S., PNL, 1991.

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

GWh/year	REMAINING POTENTIAL						
	Wind	Geo	Bio	Solar	Total	Utility	Sub-total
Total	16,673	31,226	21,251	98,362	167,512		
Imperial	230	13,452	-	14,613	28,295	IID	28,295
							41,010
Alameda	1,929	-	533	528	2,990	PG&E	
Alpine	-	-	-	-	-	PG&E	
Amador	12	-	-	13	25	PG&E	
Butte	31	-	778	75	883	PG&E	
Calaveras	9	-	175	14	199	PG&E	
Colusa	18	631	238	7	894	PG&E	
Contra Costa	-	-	264	347	611	PG&E	
Del Norte	21	-	161	11	193	PG&E	
El Dorado	80	-	399	57	536	PG&E	
Fresno	138	-	960	294	1,393	PG&E	
Glenn	25	-	519	9	552	PG&E	
Humbolt	1,692	-	1,069	46	2,807	PG&E	
Kings	6	-	645	49	699	PG&E	
Lake	49	-	49	21	119	PG&E	
Lassen	28	79	-	13	120	PG&E	
Madera	34	-	392	46	472	PG&E	
Marin	46	-	42	91	179	PG&E	
Maripos	9	-	14	7	30	PG&E	
Mendocino	77	-	510	32	618	PG&E	
Merced	1,863	-	595	78	2,535	PG&E	
Modoc	1,919	3,130	175	4	5,228	PG&E	
Monterey	37	-	-	147	184	PG&E	
Napa	1,950	102	77	46	2,176	PG&E	
Nevada	61	-	182	33	276	PG&E	
Placer	89	-	19	91	199	PG&E	
Plumas	18	118	357	8	502	PG&E	
San Benito	12	-	28	20	60	PG&E	
San Francisco	67	-	97	284	449	PG&E	
San Joaquin	222	-	792	206	1,221	PG&E	
San Luis Obisbo	28	-	98	1,763	1,889	PG&E	
San Mateo	58	-	75	259	392	PG&E	
Santa Clara	31	-	382	616	1,029	PG&E	
Santa Cruz	37	-	135	93	266	PG&E	
Shasta	77	-	-	59	136	PG&E	
Sierra	3	-	26	1	31	PG&E	
Siskiyou	40	6,276	715	16	7,046	PG&E	
Solano	380	-	247	145	772	PG&E	
Sonoma	28	-	296	168	492	PG&E	
Stanislaus	49	-	434	164	648	PG&E	
Sutter	-	-	427	29	456	PG&E	
Tehema	37	-	406	21	464	PG&E	
Trinity	12	-	252	5	270	PG&E	
Tuolumne	37	-	175	20	231	PG&E	
Yolo	9	-	308	62	379	PG&E	
Yuba	6	-	329	22	358	PG&E	

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

							93,214
Inyo	12	989	-	7	1,008	SCE	
Kern	-	-	979	20,472	21,451	SCE	
Los Angeles	156	-	2,024	9,678	11,858	SCE	
Mono	-	-	-	5	5	SCE	
Orange	49	6,362	872	1,041	8,325	SCE	
Riverside	3,760	-	495	11,007	15,263	SCE	
San Bernardino	737	-	709	31,710	33,156	SCE	
Santa Barbara	61	-	104	146	311	SCE	
Tulare	110	-	818	135	1,064	SCE	
Ventura	123	87	287	276	773	SCE	
San Diego	147	-	950	2,808	3,905	SDG&E	3,905
Sacramento	12	-	631	447	1,090	SMUD	1,090
TOTAL	16,673	31,226	21,251	98,362	167,512		

Notes:
Where RER estimate of total technical potential for a specific technology in a specific county has been exceeded by online and/or proposed facilities, remaining potential was set to 0.

A high-level assessment of renewable energy potential in the WECC published in July 2002 by the Land and Water Fund of the Rockies was used as the primary data source for technical potential for the Western Electricity Coordinating Council (WECC) region: Renewable Energy Atlas of the West: A Guide to the Region's Resource Potential. California specific data comes in part from the Regional Economic Research, Technical Potential of Renewable Resource Technologies, published in June 2002, which was used as a standard against which other data for California were measured.

Except where noted, figures are estimates of remaining potential after existing and proposed projects have been subtracted from the total technical potential. The data for existing and proposed projects exclude renewable technologies that are not appropriate for large-scale electricity generation or that have unproven technical issues, including hot dry rock and magma (geothermal).

Data on technical potential was drawn from the following sources: (1) Technology Potential of Renewable Resource Technologies, RER, June 2002; (2) Renewable Energy Atlas of the West, Land and Water Fund of the Rockies; (3) Generating Solutions, Environment California, 2003; (4) Renewable Energy for California, Renewable Energy Policy Project, March 2002; (5) Fuel from the Sky, NREL, July 2002; (6) Assessment of the Available Windy Land Area and Wind Energy Potential in the U.S., PNL, 1991.

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Remaining Potential Renewable Energy in California in top 19 Counties with the most Renewable Energy Potential (excludes 16,428 GWh/year)

				Remaining Potential broken out by technology				
	Online	Proposed	Remaining Potential	Wind	Geothermal	Biomass	Solar	
Imperial	6,266	2,453	28,295	230	13,452	-	14,613	IID
								SCE
Kern	3,221	11,620	21,451	-	-	979	20,472	
Orange	284	14	8,325	49	6,362	872	1,041	
Riverside	1,536	1,141	15,262	3,760	-	495	11,007	
Los Angeles	1,080	853	11,859	156	-	2,024	9,678	
Inyo	2,409	-	1,009	12	989	-	7	
Mono	848	2,851	5	-	-	-	5	
San Bernardino	18	288	33,156	737	-	709	31,710	
								PG&E
Modoc	-	828	5,229	1,919	3,130	175	4	
Lake	5,932	-	119	49	-	49	21	
Alameda	916	675	2,990	1,929	-	533	528	
Humbolt	319	-	2,807	1,692	-	1,069	46	
Merced	146	-	2,536	1,863	-	595	78	
Siskiyou	-	1,482	7,047	40	6,276	715	16	
Napa	-	-	2,176	1,950	102	77	46	
Solano	12	1,226	773	380	-	247	145	
Fresno	535	18	1,392	138	-	960	294	
San Joaquin	443	-	1,220	222	-	792	206	
								SDG&E
San Diego	60	1,303	3,905	147	-	950	2,808	
Total	24,025	24,753	149,555	15,275	30,312	11,243	92,725	

Existing, proposed, and remaining potential (GWh/year)	198,333	Top 19 counties
	167,512	All CA counties
	(30,821)	Difference

Notes:
While all counties have some renewable potential, the above 19 were deemed to have the greatest potential, and thus, were highlighted for this analysis.

Except where noted, figures are estimates of remaining potential after existing and proposed projects have been subtracted from the total technical potential. The data for existing and proposed projects exclude renewable technologies that are not appropriate for large-scale electricity generation or that have unproven technical issues, including hot dry rock and magma (geothermal).

Data on technical potential was drawn from the following sources: (1) Technology Potential of Renewable Resource Technologies, RER, June 2002; (2) Renewable Energy Atlas of the West, Land and Water Fund of the Rockies; (3) Generating Solutions, Environment California, 2003; (4) Renewable Energy for California, Renewable Energy Policy Project, March 2002; (5) Fuel from the Sky, NREL, July 2002; (6) Assessment of the Available Windy Land Area and Wind Energy Potential in the U.S., PNL, 1991.

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (emphasis is on wind, geothermal, and biomass)

Range of Technical Potential in California, by Technology

	Estimated total technical potential (Gwh/year)			
California only	Wind	Geothermal	Biomass	Solar
Low	26,900	28,200	9,900	60,600
High	85,900	104,300	28,500	128,000
RER study	27,300	48,400	28,500	99,300

	Estimated total technical potential (000 Gwh/year)			
Study	Wind	Geothermal	Biomass	Solar
Regional Economic Research, June 2002, *Technology Potentail of Renewable Resource Technologies*	27.3	48.4	28.5	99.3*
Land and Water Fund of the Rockies et. al., July 2002, *Renewable Energy Atlas of the West: A Guide to the Region's Resource Potential*	45.0	59.0	14.0	128*
Environment California, 2003, *Generating Solutions*	85.9	104.3	25.8	
Renewable Energy Policy Project, March 2002, *Renewable Energy for California*	26.9	28.2	9.9	
NREL, July 2002, *Fuel from the Sky*				60.6+
PNL, 1991, *Assessment of the Available Windy Land Area and Wind Energy Potential in the U.S.*	59.0			

* Photovoltaics and solar thermal potential combined

+ Solar thermal only

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (wind, geothermal, biomass, and solar)

Existing, Proposed, and Potential Renewable Energy Resources in WECC states

GWH	TOTAL ONLINE					PROPOSED				
	Wind	Geo	Bio	Solar	Total	Wind	Geo	Bio	Solar	Total
CA	4,271	16,708	6,477	890	28,345	12,405	5,029	3,370	144.5	20,949
OR	698	-	1,129	0.1	1,827	11,728	394	-	-	12,122
WA	591	-	2,265	0.4	2,857	34,106	-	-	-	34,106
NV	-	2,248	-	0.1	2,248	1,978	1,854	175	65.7	4,073
AZ	-	-	28	5.4	34	123	-	-	-	123
UT	-	310	32	0.0	342	460	788	-	-	1,248
NM	3	-	13	0.1	16	2,020	-	-	-	2,020
ID	-	-	683	0.2	683	613	79	-	-	692
CO	134	-	47	1.0	182	803	-	-	-	803
MT	-	-	91	0.0	91	822	-	-	-	822
WY	307	-	-	0.1	307	613	-	-	-	613
TOTAL	6,003	19,265	10,766	897	36,931	65,671	8,145	3,545	210	77,572

Notes:

*This study did not utilize the data shown on this table for California. A more conservative estimate of California's technical potential was used. As discussed in the text, estimates for California's technical potential for renewable energy vary widely. See other tables in Appendix A, B, and C for the data used for California.

The Energy Commission annually publishes the "J-11" table, which details the amount of generation from specific resource types (i.e. GWh from Nuclear or GWh from Geothermal). The J-11 data were used to estimate the 2001 baseline for the "rest of the state" (i.e., not IOU, not ESP/CCA) retail sales. J-11 data for 2001 total 27,759 GWh. The breakdown (in GWh) between resources is: Geothermal - 13,619; Organic Waste (biomass) - 6,185; Wind - 3,242; Solar - 837; and Small Hydro (under 30 MW) - 3,876. J-11 data is actual data for a specific year. Where the analysis called for an estimate of average renewable energy generation, J-11 was not used.

This analysis gathered data on existing on-line facilities in California and the WECC during the end of 2002. Data source for existing on-line facilites outside of California were drawn from the U.S. DOE Energy Efficiency and Renewable Energy database. To convert from MW to GWh, the following capacity factors were applied: Wind - 25%; Geothermal - 90%; Biomass - 71% in California and 69% in the WECC; and Solar Thermal - 27%. The figures produced using these capacity factors provide an approximate average amount of energy these facilities could generate each year. Actual performance will vary year to year. The conversion factor for proposed and potential solar thermal is 15%, as it assumes no use of natural gas.

A high-level assessment of renewable energy potential in the WECC published in July 2002 by the Land and Water Fund of the Rockies was used as the primary data source for technical potential for the Western Electricity Coordinating Council (WECC) region: Renewable Energy Atlas of the West: A Guide to the Region’s Resource Potential. California specific data comes in part from the Regional Economic Research, Technical Potential of Renewable Resource Technologies, published in June 2002, which was used as a standard against which other data for California were measured.

Except where noted, figures are estimates of remaining potential after existing and proposed projects have been subtracted from the total technical potential. The data for existing and proposed projects exclude renewable technologies that are not appropriate for large-scale electricity generation or that have unproven technical issues, including hot dry rock and magma (geothermal). The principal focus in that discussion is on solar thermal electric potential, but solar photovoltaic potential has also been included when it has been grouped with solar thermal potential.

Appendix C. Data Tables for Existing, Proposed, and Potential Renewable Energy in California and other WECC states (wind, geothermal, biomass, and solar)

Existing Renewable Energy Resources in WECC states

GWH	TOTAL POTENTIAL					REMAINING POTENTIAL				
	Wind	Geo	Bio	Solar	Total	Wind	Geo	Bio	Solar	Total
CA	45,000	59,000	14,000	128,000	246,000	28,325	37,263	4,153	126,965	196,706
OR	70,000	17,000	10,000	68,000	165,000	57,574	16,606	8,871	68,000	151,051
WA	62,000	-	11,000	42,000	115,000	27,303	-	8,735	42,000	78,037
NV	55,000	20,000	1,000	93,000	169,000	53,022	15,898	825	92,934	162,679
AZ	5,000	5,000	1,000	101,000	112,000	4,877	5,000	972	100,995	111,843
UT	23,000	9,000	1,000	69,000	102,000	22,540	7,902	968	69,000	100,410
NM	56,000	3,000	500	104,000	163,500	53,976	3,000	487	104,000	161,464
ID	49,000	5,000	9,000	60,000	123,000	48,387	4,921	8,317	60,000	121,625
CO	601,000	-	4,000	83,000	688,000	600,063	-	3,953	82,999	687,014
MT	1,020,000	-	6,000	101,000	1,127,000	1,019,178	-	5,909	101,000	1,126,087
WY	883,000	-	-	72,000	955,000	882,080	-	-	72,000	954,080
TOTAL	2,869,000	118,000	57,500	921,000	3,965,500	2,797,326	90,590	43,189	919,893	3,850,997

See notes from previous page.